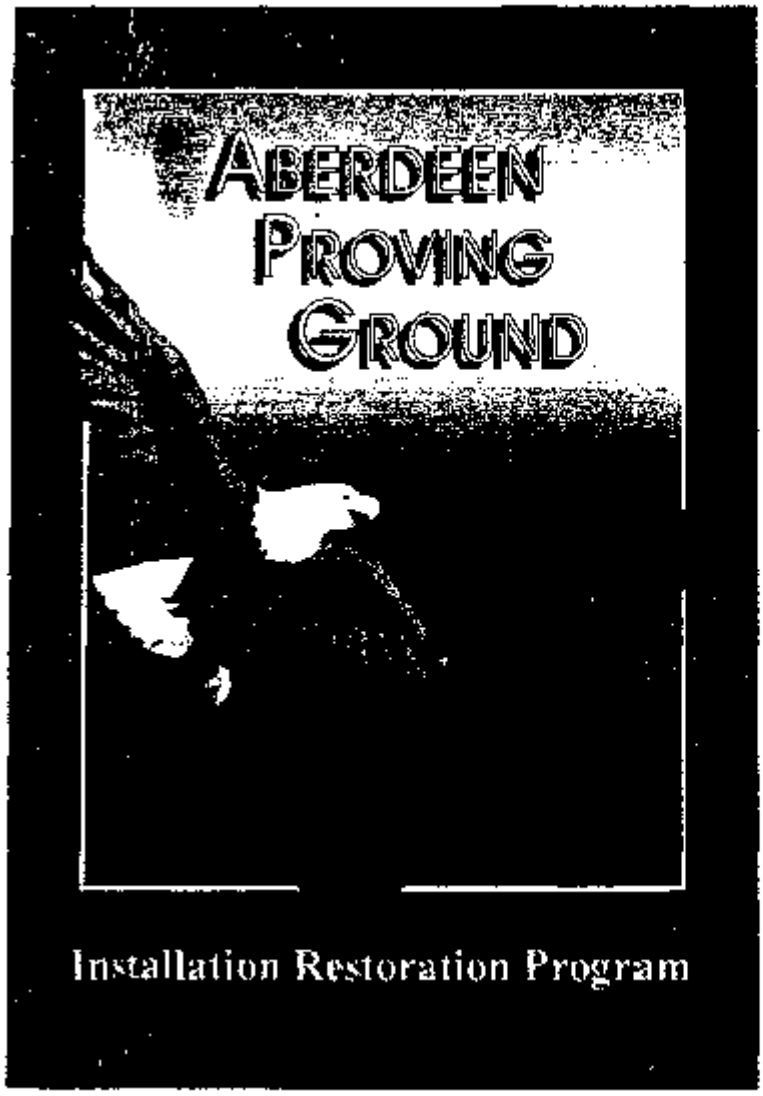
EPA/ROD/R03-01/024
2001

EPA Superfund
Record of Decision:

ABERDEEN PROVING GROUND (EDGEWOOD AREA)
EPA ID: MD2210020036
OU 09, 10
EDGEWOOD, MD
08/17/2001



RECORD OF DECISION
CARROLL ISLAND and GRACES QUARTERS
ABERDEEN PROVING GROUND
MARYLAND

CHEMICAL WARFARE MATERIEL
AND OTHER HAZARDOUS SUBSTANCES
(OPERABLE UNITS B)
AND ASSOCIATED SITES

FINAL
MAY 2001

Edgewood Area - Aberdeen Proving Ground, Maryland

This document is intended to comply with the National Environmental Policy Act of 1969

RECORD OF DECISION
CARROLL ISLAND and GRACES QUARTERS
ABERDEEN PROVING GROUND
MARYLAND

CHEMICAL WARFARE MATERIEL
AND HAZARDOUS SUBSTANCES
(OPERABLE UNITS B)

AND ASSOCIATED SITES

FINAL

Directorate of Safety, Health and Environment
Environmental Conservation and Restoration Division
Installation Restoration Program
U.S. Army Garrison Aberdeen Proving Ground, Maryland

MAY 2001

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

AEHA . . . . . United States Army Environmental Hygiene Agency (currently designated the U.S. Army Center for Health Promotion and Preventative Medicine
AOC . . . . . area of concern
APG . . . . . Aberdeen Proving Ground
ARAR . . . . . applicable or relevant and appropriate requirement
BZ . . . . . 3-quinuclidinyl benzilate (an incapacitating agent)
CERCLA . . . . Comprehensive Environmental Response, Compensation and Liability Act
CS . . . . . ortho-chlorobenzalmalononitrile (a “tear gas” material)
CWM . . . . . chemical warfare materiel
DSERTS . . . . Defense Sites Environmental Restoration Tracking System
EPA . . . . . United States Environmental Protection Agency
FFA . . . . . Federal Facility Agreement
FFS . . . . . focused feasibility study
FS . . . . . feasibility study
HD . . . . . bis(2-chloroethyl)sulfide (mustard)
LUC . . . . . land use control
LUCAP . . . . . Land Use Control Assurance Plan
LUCIP . . . . . Land Use Control Implementation Plan
MDE . . . . . Maryland Department of the Environment
NCP . . . . . National Oil and Hazardous Substances Pollution Contingency Plan
NEPA . . . . . National Environmental Policy Act
NPL . . . . . National Priorities List
O&M . . . . . operations and maintenance
RAO . . . . . remedial action objective
RCRA . . . . . Resource Conservation and Recovery Act
RFA . . . . . RCRA facility assessment
RFI . . . . . RCRA facility investigation
RI . . . . . remedial investigation
ROD . . . . . record of decision
SARA . . . . . Superfund Amendments and Reauthorization Act
SAV . . . . . submerged aquatic vegetation
SWMU . . . . . solid waste management unit
TPH . . . . . total petroleum hydrocarbons
USGS . . . . . United States Geological Survey
UST . . . . . underground storage tank
UXO . . . . . unexploded ordnance

VX . . . . . O-ethyl S-(2-diisopropylaminoethyl) methylphosphonothioate (a nerve agent)

WP . . . . . white phosphorus

EF . . . . . degrees Fahrenheit

1 DECLARATION

1.1 Unit Name and Location

Carroll Island
Edgewood Area
Aberdeen Proving Ground, Maryland
Operable Unit B (CWM and Hazardous Substances) and Associated Sites

Graces Quarters
Edgewood Area
Aberdeen Proving Ground, Maryland
Operable Unit B (CWM and Hazardous Substances) and Associated Sites

Carroll Island and Graces Quarters are 2 of 13 study areas listed within the Federal Facility Agreement (FFA) (APG and EPA, 1990) for Aberdeen Proving Ground (APG) and which contain sites/units regulated as Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Units (SWMUs) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) units.

1.2 Statement of Basis and Purpose

This Record of Decision addresses multiple units at both Carroll Island and Graces Quarters, as well as chemical warfare materiel (CWM) and hazardous substances that may exist at unknown locations. The CWM and hazardous substances are designated as Operable Units B at Carroll Island and Graces Quarters. The units addressed are:

- Carroll Island Operable Unit B (CWM and Hazardous Substances)
- Graces Quarters Operable Unit B (CWM and Hazardous Substances)
- Carroll Island Service Area Wastewater Treatment Plant
- Carroll Island Wind Tunnel Site
- Graces Quarters Service Area
- Graces Quarters Disposal Area
- Area of Concern (AOC) Associated With Bengies Point Road Dump
- Bengies Point Road Farmhouse
- Dredge Spoil Site
- Aerial Spray Grid
- AOC Associated With Decontamination Pits
- Adamsite Burial Site
- Hawthorn Cove Road
- Test Grid 1
- Magazine Area
- Animal Shelter
- Woods East of Test Grid 1
- CS Test Area

- AOC Associated With CS Test Area
- Woods North of Wind Tunnel Road
- VX Test Area
- Test Grid 2
- HD Test Area
- AOC Associated with Graces Quarters Disposal Area
- Graces Quarters Dump
- AOC Associated with Graces Quarters Dump
- HD Test Annuli
- Secondary Test Area
- The Bunker
- Test Huts
- Federal Emergency Management Agency (FEMA) Service Area
- FEMA Bunker
- Northern Perimeter Dump
- Southern Perimeter Dump
- Primary Test Area
- Southwest Perimeter Dump
- Dugway Proving Ground Test Site

The remedial actions are chosen in accordance with CERCLA as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and, to the extent practicable, with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The information supporting the decisions on the selected remedy is contained in the Administrative Record File for these sites.

The remedy selected also satisfies RCRA Corrective Action Requirements, and consistent with the FFA (p. 57), obviates the need for further corrective action under RCRA for this operable unit.

The State of Maryland Department of the Environment (MDE) concurs with the selected remedy.

1.3 Assessment of the Site

Actual or threatened releases of hazardous substances from these sites, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

1.4 Description of the Selected Remedies

Based on the military usage history of Carroll Island and Graces Quarters, these sites are expected to contain CWM. These materials pose risks to human health and the environment, and remedial action is appropriate. At both Carroll Island and Graces Quarters all CWM not located in disposal sites that already have been or are currently being remediated has been designated as

Operable Unit B. All of the land and shoreline areas are included within the Operable Unit B areas of Carroll Island and Graces Quarters.

An evaluation of potential alternatives was performed in accordance with the NCP. Based on this evaluation, the selected remedy for Operable Units B at Carroll Island and Graces Quarters is "Public Access Controls, Land Use Restrictions, and Erosion Controls".

Public access controls with land use restrictions will mitigate the principal threat to human health and the environment at Carroll Island and Graces Quarters by reducing the potential for direct contact with CWM. In combination with erosion controls, the selected remedy will reduce potential for release of CWM and hazardous materials to surface waters. The major components of the selected remedy for Operable Units B include:

- Land use restriction with primary use as a Natural Resource Management Area, and secondary use for military/industrial activities,
- Warning signs,
- Land and water patrols,
- Site inspections,
- Disposal of CWM identified by site inspections, and
- Erosion controls.

The removal actions at the Wind Tunnel Site and Service Area Wastewater Treatment Plant on Carroll Island, and at the Service Area and Disposal Site on Graces Quarters have removed potential sources of hazardous materials from these four sites. Therefore, the selected remedial action for the Carroll Island Wind Tunnel Site, Carroll Island Service Area Wastewater Treatment Plant, Graces Quarters Service Area and Graces Quarters Disposal Area is "No Further Action".

The baseline risk assessment did not identify unacceptable risks associated with the other units listed in Section 1.2, "Statement of Basis and Purpose". Therefore, the selected remedial action for these sites is "No Further Action".

1.5 Statutory Determinations

CWM is being addressed as a CERCLA pollutant and contaminant that could present an imminent and substantial danger to the public health or welfare should there be a release or substantial threat of release into the environment.

The selected remedies are protective of human health and the environment, comply with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and are cost-effective. Because treatment of the principal threats of the site was not

found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element.

Because the remedy for Operable Units B at Carroll Island and Graces Quarters will leave hazardous substances, pollutants or contaminants remaining on-site, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

1.6 Data Certification Checklist

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this site:

- Chemicals of concern and their respective concentrations.
- Baseline risk represented by the chemicals of concern.
- Cleanup levels established for chemicals of concern and the basis for these levels.
- How source materials constituting principal threats are addressed.
- Current and reasonably anticipated future land use assumptions and potential future beneficial uses of groundwater used in the baseline risk assessment and the ROD.
- Potential land and groundwater use that will be available at the site as a result of the Selected Remedy.
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected.
- Key factor(s) that led to selecting the remedies (i.e., how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, and which criteria were key to the decision).

JOHN C. DOESBURG
Major General, U.S. Army
Commander, U.S. Army Aberdeen Proving Ground

29 Mar 01
Date

CHARLES C. CANNON, JR.
Major General, USA
Chief of Staff
U.S Army Materiel Command

4 Jun 01
Date

ABRAHAM FERDAS
Director
Hazardous Site Cleanup Division
U.S. Environmental Protection Agency, Region III

8/17/01
Date

2 DECISION SUMMARY

2.1 Site Name, Location and Description

Aberdeen Proving Ground (APG) is located on the western shore of the upper Chesapeake Bay in Maryland. It is divided into the Aberdeen and Edgewood Areas by the Bush River, a large tidal estuary. The Edgewood Area is itself divided by the Gunpowder River, another large tidal estuary. Carroll Island and Graces Quarters are located within the Edgewood Area of APG on the western shore of the Gunpowder River. Carroll Island and Graces Quarters are located within Baltimore County, while the remainder of APG lies within Harford County (Figure 1).

Carroll Island lies approximately one mile south of the Hammerman Area of Gunpowder Falls State Park. The closest residents are located on Beach Road, approximately ½ mile from Carroll Island. The community of Carrollwood Manor is approximately 1½ miles away.

Carroll Island encompasses approximately 855 acres, of which 659 are classifiable wetlands. It is bounded by Seneca and Saltpeter Creeks, the Gunpowder River, and Chesapeake Bay. Portions of its shoreline are subject to storm surge and wave erosion. Because the peak elevation at Carroll Island is only 13 feet above mean sea level and much of the island is less than 10 feet above mean sea level, extensive areas are subject to flooding (ORISE, 1998a). Carroll Island is poorly drained, and ephemeral ponds and isolated marshes form during storm events.

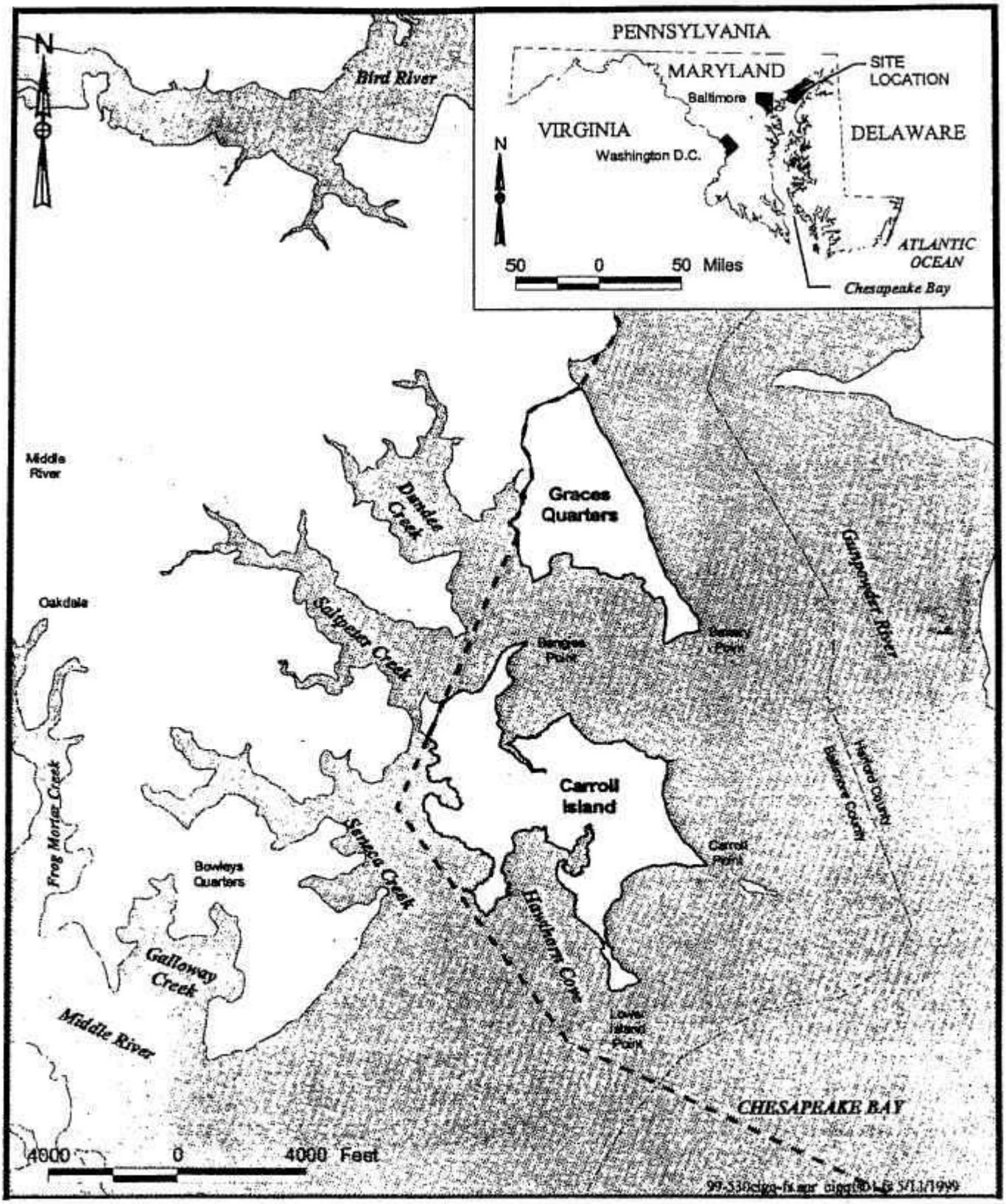
The island is largely undeveloped and is separated from the mainland by a dredged channel created for the Crane Point Power Plant located directly west of Carroll Island. Structures on the island include paved and gravel roads, the remains of two iron test towers, a small building, and concrete pads (several of which are former building foundations). Access to Carroll Island is controlled by random security patrols and other physical measures.

Graces Quarters is a peninsula located approximately one mile north of Carroll Island in Baltimore County, Maryland. It is located approximately two miles southeast of Chase, Maryland, and five miles southeast of White Marsh, Maryland. The closest residents are located in the Community of Bay Country.

Graces Quarters covers 414 acres, of which approximately 151 acres are classifiable wetlands. It is bounded by the Gunpowder River to the east, Saltpeter Creek to the south, Dundee Creek to the west, and the Hammerman area of Gunpowder State Park to the north. The land mass consists of tidal and nontidal wetlands, open fields, and wooded areas. Maximum elevation is approximately 40 feet above sea level.

Access to the property is controlled by chain link fences, a locked gate, random security patrols and other physical measures. Paved and gravel roads are present on the peninsula.

The only permanent structure is an emergency radio transmitter and tower originally constructed by the Federal Emergency Management Agency.



LEGEND

- - - ABERDEEN PROVING GROUND BOUNDARY

—·—· COUNTY BOUNDARY

Figure 1 Location of Carroll Island and Graces Quarters

2.2 Site History and Enforcement Activities

2.2.1 History

Carroll Island and Graces Quarters were acquired by the Army in 1918, but there is no evidence that military operations took place until 1944. At that time, preparations were made to use portions of Carroll Island as impact areas (for testing high explosive and smoke munitions) and chemical warfare materiel test sites (AEHA, 1989).

During the mid to late 1940s, Carroll Point and the area north of Lower Island Point (referred to as the 1,000-yard impact area) were cleared and prepared for use as impact areas for 4.2-inch mortar. An area of Carroll Island later occupied by portions of Test Grid #1 and the Aerial Spray Grid was also cleared of vegetation during the 1940s (see Figure 2 for site locations and Table 1 for site designations). It was referred to as the sand flats and was used as a CWM test area (probably including flame thrower tests) and possibly as an impact area.

During the 1940s, Graces Quarters was also developed for use as a military test facility. The area later designated as the Primary Test Area was reportedly used as the impact area (see Figure 3 for site locations, and Table 2 for site designations). Graces Quarters was also used as a firing point for mortar fire toward M-Field located to the east on the Gunpowder Neck. A timber and sandbag bunker was constructed in the northern portion of Graces Quarters as a control point during its use as an impact and firing area.

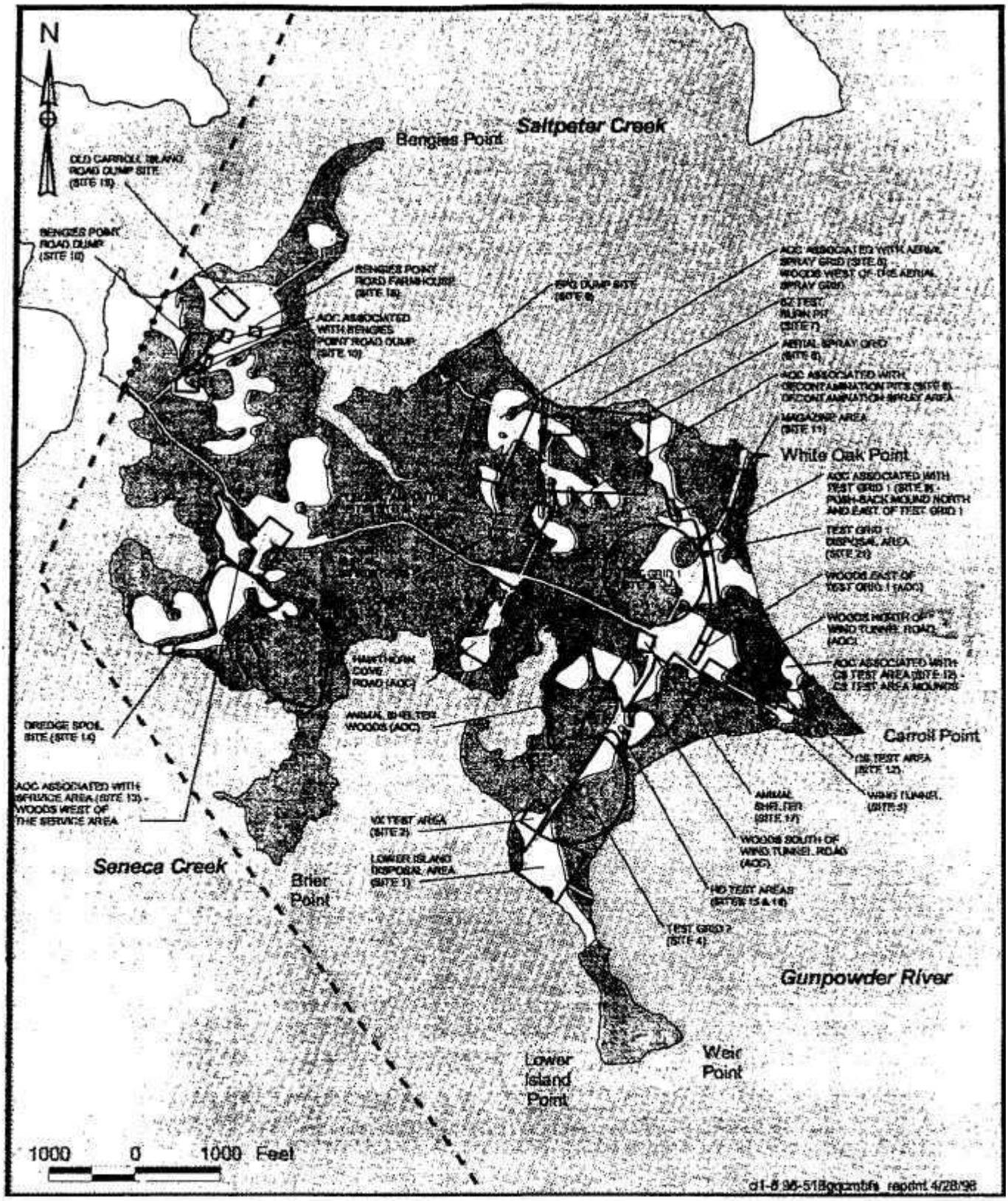
The 4.2-inch mortar fire to the impact areas of Carroll Island and Graces Quarters is known to have been primarily, and perhaps exclusively, with high explosive and white phosphorus (WP) filled rounds. During the mid 1940s the Army policy concerning "live fire" testing with lethal chemical agents was changed to restrict such activities at APG.

Testing of chemical agents and chemical ordnance at Carroll Island and Graces Quarters was conducted from the 1940s through 1971, with the testing from 1969 until 1971 restricted to non-lethal chemical material such as riot control agents, simulants and smoke. The lethal and incapacitating chemical agents used in test activities at Carroll Island and Graces Quarters included the complete range of stockpile agents as well as a variety of experimental chemicals. Detailed records of testing are available only for the latter years, from 1964 through 1971. Materials used in testing at Graces Quarters and possibly Carroll Island also included biological simulants (AEHA, 1989).

Wastes from test activities at Carroll Island and Graces Quarters were placed into either dump sites or burial pits. These disposal sites have already been remediated.

2.3 Enforcement Activities

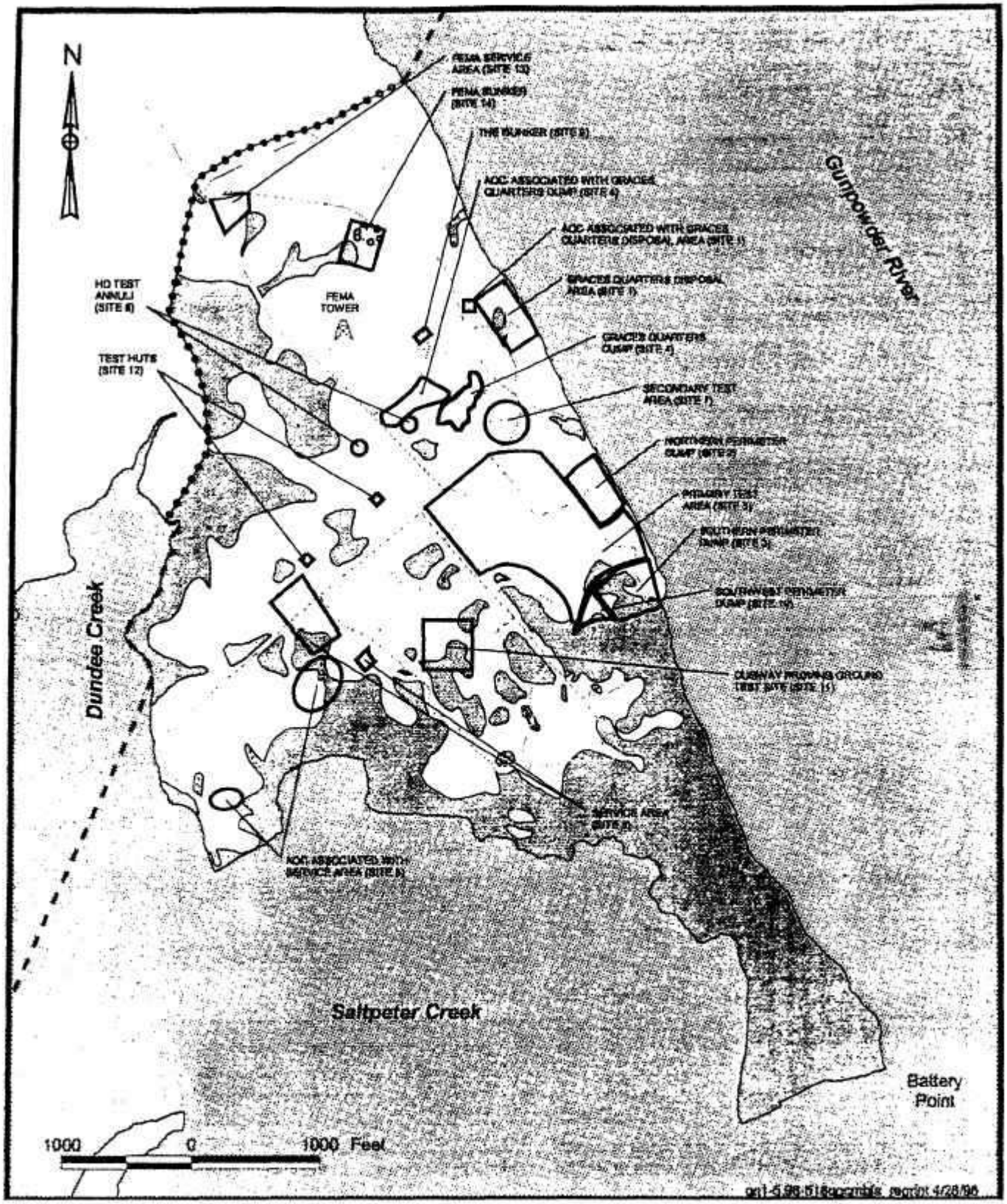
From 1984 to 1985, APG was evaluated as a potential National Priorities List (NPL) site under CERCLA. In 1985, the Edgewood Area of APG was proposed for inclusion on the NPL; it was listed on the NPL in 1990. In 1986, between the time of the proposed listing and the final listing, a RCRA corrective action permit (MD3-21-002-1355) was issued by the Environmental



LEGEND

- TIDAL WETLAND/ NON-TIDAL WETLAND
- UPLAND
- ROAD
- ABERDEEN PROVING GROUND BOUNDARY
- FENCE
- SITE BOUNDARY

Figure 2 Carroll Island - Remedial Investigation Site Locations



LEGEND

UPLAND
TID/L WETLAND/ NON-TIDAL WETLAND
ROAD
FENCE
ABERDEEN PROVING GROUND BOUNDARY
SITE BOUNDARY

Figure 3 Graces Quarters - Remedial Investigation Site Locations

Table 1. Carroll Island Sites

Carroll Island Operable Unit B

All of Carroll Island (CWM and Hazardous Substances) (EACI00)

"No Unacceptable Risk" Sites

AOC Associated With Bengies Point Road Dump (EACIO1-D)
Bengies Point Road Farmhouse (EACI01-B)
Dredge Spoil Site (EACI02-B)
Aerial Spray Grid (EACI04-A)
AOC Associated With Decontamination Pits (EACI04-C)
Adamsite Burial Site (EACI04-C)
Hawthorn Cove Road (EAC104-C)
Test Grid 1 (EACI05-A)
Magazine Area (EACI05-B)
Animal Shelter (EACI05-C)
Woods East of Test Grid 1 (EACI05-D)
Wind Tunnel (EACI06-A)
CS Test Area (EACI06-D)
AOC Associated With CS Test Area (EAC106-E)
Woods North of Wind Tunnel Road (EACI06-B)
VX Test Area (EACI07-A)
Test Grid 2 (EACI07-B)
HD Test Areas (EACI07-C)

Note: The baseline risk assessment did not identify unacceptable risks for these sites, for which no further action is necessary.

"Operable Unit A" Sites (Previous Record of Decision)

Bengies Point Road Dump (EACI01-A)
Old Carroll Island Road Dump Site (EACI01-C)
Service Area (EACI02-A)
AOC Associated With Service Area (EACI02-C)
EPG Dump Site (EACI03)
AOC Associated With Aerial Spray Grid (EACI04-A)
BZ Test Burn Pit (EACI04-D)
Decontamination Pits (EACI04-B)
AOC Associated With Test Grid 1 (EACI05-E)
Test Grid 1 Disposal Area (EACI05-A)
Woods South of Wind Tunnel Road (EACI06-B)
Animal Shelter Woods (EACI06-B)
Lower Island Disposal Area (EACI08)

Note: Remediation of these sites has been completed

Note: Removal actions have also been completed at two sites; Underground Storage Tank at the Wind Tunnel (EACI06-C) and Service Area Wastewater Treatment Plant (EACI02-A). The Service Area is also an Operable Unit A site. The Aerial Spray Grid and the Associated AOC have the same site number.

Table 2. Graces Quarters Sites

Graces Quarters Operable Unit B

All of Graces Quarters (CWM and Hazardous Substances) (EAGQ00)

"Removal Action" Sites

Graces Quarters Disposal Area (EAGQ01-A)
Service Area (EAGQ03-A)

Note: The removal actions addressed waste and contaminated soil at these sites, and no further action is necessary to protect human health or the environment.

"No Unacceptable Risk" Sites

AOC Associated with Graces Quarters Disposal Area (EAGQ01-A)
Graces Quarters Dump (EAGQ01-B)
AOC Associated with Graces Quarters Dump (EAGQ01-F)
HD Test Annuli (EAGQ01-G)
Secondary Test Area (EAGQ01-I)
The Bunker (EAGQ01-C)
Test Huts (EAGQ01-H)
FEMA Service Area (EAGQ01-D)
FEMA Bunker (EAGQ01-E)
Northern Perimeter Dump (EAGQ02-A)
Southern Perimeter Dump (EAGQ02-B)
Primary Test Area (EAGQ02-C)
Southwest Perimeter Dump (EAGQ02-B)
AOC Associated with Service Area (EAGQ03-C)
Dugway Proving Ground Test Site (EAGQ03-B)

Note: The baseline risk assessment did not identify unacceptable risks for these sites, for which no further action is necessary.

Protection Agency (EPA) Region III to address SWMUs in the Edgewood and Aberdeen Areas of APG. As required by the RCRA permit, the U.S. Army Environmental Hygiene Agency (AEHA) performed a RCRA Facility Assessment (RFA) study for the Edgewood Area. The RFA identified sites on Carroll Island that were either SWMUs or areas with potential prior releases (AEHA, 1989). In addition to the RFA, the RCRA permit required that a RCRA Facility Investigation (RFI) be performed. However, because of the final listing of the Edgewood Area on the NPL in 1990, the RFI was not completed. Further investigations were performed under CERCLA.

In 1986, before the Edgewood Area was on the NPL list, the U.S. Geological Survey (USGS), in cooperation with the Army, conducted a hydrogeologic assessment of Carroll Island and Graces Quarters (USGS, 1991 and 1996). When the Edgewood Area was placed on the NPL, remedial investigations (RI) were initiated at Carroll Island and Graces Quarters (Dames & Moore, 1997 and 1998). The RI report for Carroll Island recommended further action be taken at disposal sites because of the widespread potential for CWM and hazardous substances. Operable Unit A at Carroll Island consists of disposal pit/areas, for which a ROD was signed September 1996, with remediation recently completed (APG, 1996).

A removal action was accomplished at the Graces Quarters Service Area during 1993. A Quonset hut was removed because of the potential for CWM contamination in the ventilation system. Two underground tanks were also removed, and found to contain gasoline and diesel fuel.

During 1993 and 1994 another removal action was accomplished to remove wastes from burial pits within the Graces Quarters Disposal Area. The burial pits were located adjacent to an eroding shoreline, and the removal action was accomplished to prevent release of hazardous substances to the Gunpowder River.

A small wind tunnel test facility was constructed in 1953 at the eastern portion of Carroll Island near Carroll Point. Use of the wind tunnel in chemical agent and chemical ordnance test programs ended in the early 1970s. The above-ground portion of the facility was removed during 1993. In 1995, a 250-gallon underground storage tank that had been used to store coolant (ethylene glycol and water mixture) was removed from the site.

During the summer of 1999, a removal action was accomplished to close a small sump associated with an abandoned package wastewater treatment system for the service area. The closure was accomplished by removing sediment and water from the sump, followed by cleaning and then filling of the sump. The *Decision Document, Removal Action of a Sump Associated with the Former Service Area at Carroll Island* (APG, 1998) describes and documents the decision for this interim remedial action.

Combined Feasibility Study (FS) and Proposed Plan documents for Operable Units B for Carroll Island and Graces Quarters were completed in July 1998 (ORISE, 1998a and 1998b). The Proposed Plan identified “Public Access Controls with Land Use Restrictions” as the preferred alternative. In response to public comments asking that erosion control measures be considered for reducing the risks associated with CWM, an FS addendum (Dames & Moore, 1999a) and a

revised Proposed Plan (Dames & Moore, 1999b) were prepared. The FS addendum evaluated process options for control of shoreline erosion, and developed and evaluated a third remedial alternative for Operable Units B involving public access controls, land use restrictions and erosion controls. The revised proposed plan identified "Public Access Controls, Land Use Restrictions, and Erosion Controls" as the preferred remedial alternative for Operable Units B at Carroll Island and Graces Quarters.

2.4 Community Participation

CERCLA requires that the public be given an opportunity to review and comment on the proposed remedial alternative. Public participation requirements are listed in Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternatives for addressing the risks associated with CWM and hazardous substances at Operable Units B of Carroll Island and Graces Quarters. The Administrative Record File must be established at or near the facility at issue. The APG Community Relations Plan is designed to facilitate public involvement in the decision-making process for selection of remedial alternatives (ICF, 1998). The APG Community Relations Plan addresses the requirements of CERCLA and the National Environmental Policy Act of 1969 (NEPA). Section 117(a) of CERCLA, as amended, requires the public be given notice of any proposed remedial action, and that the public be provided an opportunity to participate in the selection of the remedial action. The Proposed Plan for Operable Units B at Carroll Island and Graces Quarters (Dames & Moore, 1999b), a part of the Administrative Record File, highlights key issues and identifies the preferred action for addressing the CWM and hazardous substances.

The public participated in the decision process for the removal actions that have been accomplished for the Carroll Island Wind Tunnel, the Carroll Island Service Area Wastewater Sump, the Graces Quarters Service Area, and the Graces Quarters Disposal Area.

The FFA Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the EPA Region III office and at the following locations:

Harford County Library
Edgewood Branch
2205 Hanson Road
Edgewood, MD 21040
410-612-1600

Harford County Library
Aberdeen Branch
21 Franklin Street
Aberdeen, MD 21001
410-27-5608

Miller Library
Washington College
Chestertown, MD 21620
410-778-2800

The public was notified of the public comment period for the Proposed Plan through notices in the *Aegis*, the *Kent County News*, the *Cecil Whig*, *The Avenue*, and the *Essex Times*.

The public comment period began on 26 April 2000 and ended on 9 June 2000. A public comment meeting was held on 11 May 2000. A Responsiveness Summary was prepared to address comments received during the public comment period. The Responsiveness Summary is provided in Appendix A of this document.

2.5 Scope And Role Of Operable Units And Response Action Within Site Strategy

An Operable Unit is defined by the NCP as a discrete action which is an incremental step toward comprehensively mitigating site problems. The investigation of Carroll Island and Graces Quarters, and the assessment of risks to human health and the environment has resulted in the definition of Operable Units as:

Carroll Island, Operable Unit A – Disposal Pits

Thirteen sites were discovered on Carroll Island, which potentially contained waste from testing activities. There was a concern about buried wastes resulting in contaminant migration to the surrounding environment because of the shallow water table, flooding, and shoreline erosion. Therefore, a Focused Feasibility Study (FFS) was conducted to address the disposal pits. The results of the FFS concluded that excavation of the pits was necessary, and a ROD was signed in September 1996. As discussed further in the following section, removal actions for Operable Unit A - Disposal Pits have been addressed separately from the plan of action for Operable Unit B.

Carroll Island, Operable Unit B - CWM and Hazardous Substances

Carroll Island was used for impact areas and CWM test sites from 1944 to 1971. Wastes from testing activities were disposed of by dumping or burial at numerous locations. Carroll Island is approximately 80 percent wetlands, and even though thorough environmental investigations have been conducted, all the wastes associated with testing and support activities could not be located or identified because of the marshy areas and heavy vegetation. Operable Unit B encompasses the entire island to provide protection of human health and the environment from potential CWM and hazardous substances.

Graces Quarters, Operable Unit A –Contaminated Groundwater Associated with the Primary Test Area

Based on the results of the RI and risk assessment, concentrations of chlorinated solvents in the groundwater - primarily 1,1,2,2-tetrachloroethane and carbon tetrachloride – in the vicinity of the Primary Test Area (Site 5, EAGQ02-C) warrant remediation. This record of decision does not address contaminated groundwater at Graces Quarters. An FFS is being prepared to address the contaminated groundwater.

Graces Quarters, Operable Unit B - CWM and Hazardous Substances

The southern portion of Graces Quarters was used as an impact area during World War II. Riot control, CWM, smoke, and simulants were tested on the peninsula from the early 1950s to 1971. Thorough environmental investigations have been conducted; however, Graces Quarters is densely vegetated in some areas and contains wetlands in others, and all the waste associated with testing and support activities from the past could not be located or identified. Operable Unit B encompasses all of Graces Quarters to address all CWM and hazardous substances that have not been located.

Operable Units B for Carroll Island and Graces Quarters were combined because of the similarity of environments, contaminants, and potential remedial actions. Operable Unit A - Disposal Pits at Carroll Island and Operable Unit A – Contaminated Groundwater at Graces Quarters were addressed separately from the plan of action for Operable Units B.

This ROD documents a plan of action to prevent human exposure to contaminants from Carroll Island and Graces Quarters. This recommended plan of action has been developed because it is still possible that sporadic contamination exists at both areas (such as at small disposal areas and individual buried munitions) that could not be found using existing technology. Nevertheless, there are no remaining positively-identified areas that contain CWM or hazardous substances on Carroll Island and Graces Quarters.

This ROD documents a "No Further Action" decision for the Carroll Island Wind Tunnel, the Carroll Island Service Area Wastewater Treatment Plant, the Graces Quarters Service Area, and the Graces Quarters Disposal Area. Removal actions at these sites have eliminated hazardous materials and potential threats to human health and the environment.

This ROD also documents a "No Further Action" decision for the Carroll Island and Graces Quarters sites for which the baseline risk assessment did not identify unacceptable risk. These sites are listed in Tables 1 and 2.

2.6 Site And Operable Unit Characteristics

Initial screening and records review identified 21 sites and 11 AOCs to be included in the Carroll Island RI. RI activities consisted of historical searches, wetlands delineation, ecological investigations, well installations, geophysical and soil gas surveys, environmental sampling, and archeological surveys.

As discussed in the previous section, four operable units were developed for Carroll Island and Graces Quarters as a result of the investigations. Operable Units B were developed based on the knowledge of Carroll Island and Graces Quarters through the RI process and known historical uses of the area. Since the time field work was started by the Army in 1977, many surface and subsurface disposal areas containing hazardous substances have been found through investigations and visual observations. Even though environmental investigations have been conducted, all the waste associated with testing and support activities from past activities has not been located or identified. Many disposal areas that were not originally reported have been

found by visual observation or magnetometry, or both. Carroll Island contains highly vegetated areas, such as wetland, that can hide or cover surface or subsurface disposal areas from both visual or magnetometry detection. Waste has also been identified after it has been exposed from shoreline erosion or frost heaving.

2.6.1 Removal Action at Service Area on Carroll Island

The Service Area, which is designated as Site 13 (Cluster 2, EACI02-A), was originally identified as a possible source of environmental contamination during the RCRA Facility Assessment conducted in 1989. The site consisted of two Quonset huts and several small facilities for water supply and wastewater management in support of testing activities on Carroll Island. The remains of the wastewater treatment plant consisted of a small metal unit on a grate over a concrete sump.

During the Carroll Island RI, volatile organic compounds, semi-volatile organic compounds, pesticides, polychlorinated biphenyls, and metals were detected in sediment samples in the sump. The measured concentrations of these contaminants did not exceed any state or federal regulatory standards, but did exceed RI comparison criteria, which, were based on previous background sampling conducted in 1993. The Baseline Human Health Risk Assessment indicated no risks or hazards. The Ecological Risk Assessment did reveal potential effects to aquatic organisms living within the sump. The walls of the cement-lined sump were elevated approximately 2 feet above the ground, and the sump was covered by steel plates. This habitat was expected to be capable of supporting a very limited number of benthic invertebrates. Adverse effects, if occurring; would have been limited to these species. Based on the ecological risks, and the possibility that contaminated sediment might be disturbed in the future and released to other media, a removal action was recommended in the RI for the sump at the Service Area. EPA and MDE concurred with the RI's recommendation of a removal action at this site.

The removal action, which was completed in July 1999, consisted of removing the contaminated contents of the sump while leaving the sump in place. The following measures were performed during this removal action: dewatering the sump, removing the sediments, high pressure washing, plugging all outgoing lines, and filling the sump with a fill material.

2.6.2 Removal Action at the Wind Tunnel on Carroll Island

The Wind Tunnel, which is identified as Site 5 (Cluster 6, EACI06-A), was constructed in 1953 for use in testing CWM in an enclosed test chamber. The facility consisted of the Wind Tunnel building, a control room, a scrubber system, and a 250-gallon UST for storage of an ethylene glycol/water mixture used in the scrubber. Use of the Wind Tunnel was terminated in 1973.

The Wind Tunnel Site is located on the eastern half of Carroll Island at Carroll Point. It is bordered by a low lying field to the north, marsh to the west, and the Gunpowder River to the south. The area sometimes becomes flooded during storm events. Field inspections of the site in 1993 revealed the structure was in poor condition. There was also evidence trespassers had gained access to the building. Because of the deteriorating condition of the building and the potential for residual chemical contamination of the equipment inside, the site was considered to be a physical hazard and suspect source area for contamination, which, if present, could enter the

environment. A decision was therefore made to dismantle the facility. During the summer of 1993, the Army removed the building, all of the equipment associated with the Wind Tunnel, and the scrubber system, including the stack. The structures and equipment associated with the Wind Tunnel were disassembled, cut into smaller pieces, and placed in wooden boxes. The air inside the crates was sampled, and no CWM was detected. Holes in the building slab were sealed with concrete.

Based on the air sampling results, the crates were classified as "3X." This is the designation for items that have been potentially exposed to CWM and have been surface decontaminated, if required, by locally approved procedures; and then bagged or contained. This classification also means that appropriate tests or monitoring have verified that no vapor concentrations are above U.S. Army specified detection limits. The material was then transported to the Edgewood Area of APG, thermally treated at the decontamination/detoxification facility to "5X," which is the designation that indicates the material is clean and may be released from government control without precautions or restrictions. The treated material was then recycled.

In August 1995, the 250-gallon UST was removed from the Wind Tunnel Site. Liquid remaining in the UST was analyzed for CWM, which was not detected. The liquid was then pumped out of the tank prior to the initiation of the UST excavation activities. No holes were observed in the tank. Soil samples collected during the removal showed no visual contamination, and no ethylene glycol was detected during laboratory analyses. The tank was cleaned, cut up, and recycled as scrap metal. The excavated area was filled with gravel, and the excavated soil was spread on the surface of the site as a means of disposal, as approved by MDE.

2.6.3 Removal Action at the Service Area on Graces Quarters

The Quonset hut at the Service Area (Site 8, Cluster 3, EAGQ03-A) was dismantled in 1993 to safely remove ventilation equipment that was believed to be a potential source of CWM contamination. The Quonset hut was cut up, and pieces of the hut and material from inside the hut were placed in wooden crates lined with plastic. After a minimum of 4 hours at 70 degrees Fahrenheit (EF), the headspace of each wooden crate was sampled for CWM; none was detected. Based on these results, the crates were classified as "3X." The material was then transported to the Edgewood Area, thermally treated at the decontamination/detoxification facility to "5X," and recycled through the Army's Defense Reutilization and Marketing Office. A real-time air monitoring platform was used to collect air samples in the vicinity of the hut, and test for the possible presence of chemical agents both before and during the removal actions. No elevated readings were obtained.

In addition to dismantling the Quonset hut, APG also removed and closed two USTs from this site in 1995. These two USTs consisted of a 250-gallon tank that contained a gasoline-water mixture and a 1,000-gallon diesel fuel tank, which were located next to the Quonset hut pad. The contents of the USTs were sampled and tested for chemical agents, which were not detected. The tank contents were then pumped out, and either disposed of or recycled. The two USTs were excavated and removed in May 1995. After the tanks were brought to the ground surface, they were cleaned and transported off-post to be punctured and removed from future use. The tanks appeared to be in good condition, with no obvious leaks or holes.

After removal of the 250-gallon UST, soil was excavated until no staining was observed. Soil samples were collected from the bottom and sidewalls of the excavation, and from the excavated soil. The analytical results indicated that the concentrations of total petroleum hydrocarbons (TPH) in the post-excavation and stockpiled soil were below the cleanup criteria of 100 ppm. Based on these results, no further action was necessary, and the stockpiled soil was backfilled into the excavation.

After removal of the 1,000-gallon UST, soil was excavated until no further staining was observed, and until TPH levels in post-excavation soil samples collected from the bottom and sidewalls of the pit were reduced below 100 ppm. The excavation was stabilized, and a pond was established at the site. This work was conducted in conjunction with APG's Natural Resources personnel to enhance the natural wildlife habitat at Graces Quarters. Composite samples collected from the stockpiled soil exceeded the 100-ppm limit for TPH. Therefore, the excavated soil was manifested and transported for treatment at a permitted off-post incinerator.

2.6.4 Removal Action at the Disposal Area on Graces Quarters

Between February 1993 and April 1994, removal actions were undertaken to mitigate the environmental and health hazards presented by debris buried in disposal pits and surrounding area as at the Graces Quarters Disposal Area (Site 1, Cluster 1, EAGQ01-A). Because of rapid shoreline erosion in the immediate vicinity of the pits, at least one pit eroded in the 1960s, exposing wastes to the Gunpowder River. The removal actions were designed to remove the contents of the remaining pits prior to their exposure to the environment.

Prior to initiating the removal actions, unexploded ordnance (UXO) surveys were conducted in the vicinity of the suspected disposal pit areas. No UXO was found during these surveys. The locations and dimensions of four disposal pits were then determined by ground penetrating radar and electromagnetic surveys. The four pits ranged in size from approximately 10x20 feet to 40x50 feet, with depths between 1 and 5 feet below ground surface. Following the identification of the four disposal pits, the pit contents were excavated by a combination of hand and mechanical excavation (with an extended boom excavator). The debris removed from the pits included ordnance-related items and miscellaneous debris, including 431 40-millimeter (mm) rounds, one 1,000-pound GB bomblet shell (empty casing), one nonexplosive rocket, metallic and other debris, and white wax-like material. Three of the 40-mm rounds were determined to be unstable and highly explosive, and not to contain liquid. These ordnance items were detonated onsite in accordance with Army protocols. The remaining rounds, which were either stable or dummy rounds, were disposed of at the Edgewood Peninsula in accordance with established U.S. Army protocols.

The other debris and non-explosive items were placed in wooden crates sealed with a plastic cover or in steel drums. CWM headspace monitoring was then performed for each of the crates and drums. All of the crates and drums exhibited negative results for CWM, and were classified as "3X". The crates were transported to the decontamination/detoxification facility at the Edgewood Area for thermal treatment to "5X" and disposal. The drums were transported to a permitted offsite disposal facility in accordance with applicable regulations.

Following the removal of the pit contents, post-excavation composite soil samples were collected from the bottom and sidewalls of each pit and from the stockpiled soil excavated from each pit. No CWM or CWM degradation products were detected in any of these samples. With the exception of beryllium, none of the parameters detected in the post-excavation composite soil samples collected from the bottom and sidewalls of the disposal pits exceeded hazardous waste criteria defined in RCRA corrective action standards. While beryllium concentrations in some samples exceeded these criteria, the beryllium was concluded to be naturally occurring. The stockpiled soil from three of the pits was determined to be nonhazardous according to RCRA criteria, and was therefore used for site grading purposes. The stockpiled soil from one pit contained polychlorinated biphenyls at concentrations above these criteria, and was therefore manifested and transported to an offsite disposal facility, together with all drummed materials.

Site closure was conducted by lining the four open pits with a geotextile material and backfilling the excavations with clean soil. After the pits were backfilled, the site was restored by reseeding and mulching disturbed areas. Based on the documented site history and ground penetrating radar and electromagnetic survey work conducted during this removal action, it was concluded that no disposal pits remain at the Graces Quarters Disposal Area.

2.7 Current and Potential Future Site and Resource Uses

No military activities are currently conducted at either Carroll Island or Graces Quarters. These areas are currently designated as natural areas.

The most conservative (highest exposure) receptor evaluated in the baseline risk assessments was a natural resources management worker, with exposure factors the same as the standard EPA default exposure factors for industrial workers.

The land uses that will be available as a result of the Selected Remedies are primary use as a limited-access Natural Resource Management Area, and secondary use for military/industrial activities.

The future use of groundwater at Carroll Island is unrestricted. The groundwater at Graces Quarters is being addressed as a separate operable unit, and is not addressed by this ROD.

2.8 Summary Of Operable Unit Risks

Initial screening and records review identified 31 sites to be included in the Carroll Island RI, and 17 sites in the Graces Quarters RI. These sites are listed in Table 1 and Table 2, together with their Site and Cluster identification numbers presented in the RI reports, and their Defense Sites Environmental Restoration Tracking System (DSERTS) numbers.

Thirteen of the sites at Carroll Island were included in Operable Unit A for accelerated evaluation, due to the likelihood that they contained CWM or hazardous substances, based on historical information, visual observations, and geophysical surveys. As discussed below, these 13 sites have been remediated. The results of the baseline risk assessment presented in the Carroll Island RI indicated that no unacceptable risks or hazards are associated with any of the other 18 sites, and that no further action would be required for those individual sites. However,

all 31 sites investigated in the Carroll Island RI were incorporated into Operable Unit B, due to the potential presence of CWM or hazardous substances throughout Carroll Island.

Based on the results of the baseline risk assessment, the Graces Quarters RI concluded that no further action would be required. However, all of the 17 sites were incorporated into Operable Unit B at Graces Quarters, due to the potential presence of CWM or hazardous substances throughout Graces Quarters.

The Graces Quarters RI also recommended that additional soil samples be collected at the Test Huts (Site 12, Cluster 1, EAGQO 1-H) to "delineate a mercury soil hot spot", and that a bioaccumulation study be conducted at this site to assess the potential impact of mercury in the soil on ecological receptors. These recommendations have been implemented in a bioaccumulation study conducted by the University of Maryland, using mercury-contaminated soil from the Northeast Test Hut at this site. In this study, the bioaccumulation of both total mercury and methyl mercury were investigated in a series of experiments on earthworms exposed to the mercury-contaminated soil. The daily doses of total and methyl mercury ingested by robins and shrews consuming these earthworms were then calculated and compared to risk assessment derived values. The study concluded that the small area of mercury-contaminated soil at Site 12 would not have adverse ecological impacts, and that no further action is required at this site.

RI activities consisted of historical searches, wetlands delineation, ecological investigations, well installations, geophysical and soil gas surveys, environmental sampling, and archeological surveys. An explosive ordnance survey was conducted along portions of the boundaries of Carroll Island and Graces Quarters in April 1997. As discussed previously, two operable units were developed for both Carroll Island and Graces Quarters as a result of the investigations.

Operable Units B were developed based on the knowledge of Carroll Island and Graces Quarters through the RI process and known historical uses of the areas. Since the time environmental restoration activities were started by the Army in 1977, many surface and subsurface disposal areas containing CWM and hazardous substances have been found through investigations and visual observations. Even though thorough environmental investigations have been conducted, some wastes associated with testing and support activities from past activities may not have been located or identified. Many disposal areas that were not originally reported have been found by visual observation or magnetometry, or both. However, Carroll Island and Graces Quarters contain highly vegetated areas, such as wetlands, that can hide or cover surface or subsurface disposal areas from both visual or magnetometry detection. In some cases, wastes that had not previously been identified were observed after they became exposed as a result of shoreline erosion or frost heaving.

CWM, hazardous substances and UXO have also been discovered during fieldwork as a result of clearing areas of UXO to conduct RI activities. During the RI fieldwork conducted at Carroll Island, two 40-millimeter high explosives rounds were uncovered near the Lower Island Disposal Area. Fieldwork conducted at Graces Quarters uncovered 2.36-inch rockets at the Primary Test Area, and 4.2-inch mortar rounds were found on the beach area adjacent to the Northern and Southern Perimeter Dumps. In addition, ordnance wastes that potentially contain

CWM and explosive substances have been identified during the removal actions performed at the Operable Unit A disposal pits on Carroll Island. Most of the wastes recovered from these pits consists of non-hazardous military testing equipment such as metal, glass, and plastic vessels and components; non-hazardous construction rubble such as building debris and pieces of concrete; and non-hazardous soil. Approximately 50 glass and steel containers filled with unknown liquids were also removed from the pits, and transported to the Chemical Transfer Facility at APG to test for the possible presence of chemical agents. In addition to these wastes, over 1,200 intact ordnance items and 15,000 ordnance components were recovered from the pits. Approximately 40 percent of these ordnance items and components are estimated to potentially contain chemical agents or their residues. Because these ordnance wastes and disposal sites have been found during these other activities, it is likely that CWM, hazardous substances and UXO are present at other areas on Carroll Island and Graces Quarters.

Risk assessments are usually performed on sites that contain measurable levels of contaminants in environmental media such as soil or groundwater. Using concentrations of contaminants, an estimated risk to human health and the environment can be quantified. Because this ROD is addressing contamination that may potentially exist but has not been identified, a quantitative risk assessment could not be performed. However, there are known side effects of the contaminants that may be present. Based on the historical uses of Carroll Island and Graces. Quarters, the principal categories of contaminants that could be present include CWM, explosives, and associated degradation products. In addition, other contaminants that could potentially be present include volatile organic compounds, semivolatile organic compounds, pesticides/polychlorinated biphenyls, and inorganics.

CWM may cause a variety of toxic effects and even fatality (if large enough dose) when either inhaled, absorbed through the skin, or ingested with contaminated food or water. These effects may include breathing difficulty, convulsions, vision difficulties, and eye and skin blisters. Explosives, in addition to posing explosion hazards at high concentrations, may cause health effects at lower concentrations including irritated eyes, skin, throat, and lungs; liver and kidney damage; nerve damage; and convulsions. The other categories of contaminants listed above can also have a wide range of potential health effects, depending on the specific types and concentrations of contaminants that might be present.

Given current land use and the fact that the wastes have not been identified, there are no known complete exposure pathways. In addition, there are several mitigating factors that may reduce the potential risks posed by any CWM or hazardous substances present at Carroll Island and Graces Quarters. In the case of Carroll Island, a substantial amount of the CWM and hazardous substances buried in this area have already been removed as a result of the recent excavation activities conducted at the Operable Unit A disposal pits. In addition, any CWM entering the environment due to leakage from munitions at Carroll Island or Graces Quarters would be subject to hydrolysis reactions, which are generally effective in degrading most chemical agents and reducing the hazards that they pose. However, some of the byproducts of these hydrolysis reactions may also be toxic. It should also be noted that the CWM and hazardous substances present at Carroll Island and Graces Quarters have been there for several decades, as a result of the testing, dumping, and burial activities that occurred approximately 30 to 50 years ago. While some shoreline erosion has continued to occur since that time, no noticeable permanent damage

to the Chesapeake Bay or other ecological resources has been observed. Therefore, the potential for significant future harm to human health or the environment due to possible exposure to CWM or hazardous substances appears to be low.

Because some CWM and hazardous substances are still likely to be present at Carroll Island and Graces Quarters, the potential for future exposure to receptors remains a concern unless appropriate remedial actions are taken. If exposure occurred, potential human receptors might include outdoor maintenance workers, security workers, construction/excavation workers, nearby off-site residents, nearshore fishermen, consumers of fish caught near Carroll Island or Graces Quarters, hunters and trappers, consumers of game from these areas, nearshore swimmers, and trespassers or visitors. Potential receptors could be exposed to contamination via incidental ingestion or direct dermal contact with soil, surface water, sediment, or exposed wastes. In addition, the rupture of chemical containers could also result in chemical releases to the air and thus expose potential receptors via inhalation. Actual or threatened releases of hazardous substances from this site, if not addressed by appropriate remedial measures, may therefore present a current or potential threat to public health or the environment.

All of the CWM and hazardous substances in metal containers that remain at Carroll Island and Graces Quarters will eventually be released to environmental media. The release of chemical material to subsurface soil while the material is buried would not pose a substantial threat to human health and the environment, because the lethal chemical warfare agents are not persistent when dissolved in water, and will therefore not migrate to groundwater or the air.

The greatest threat from CWM and hazardous substances is associated with releases that may occur as future erosion exposes containers on beaches. As items containing chemicals are exposed by beach erosion, the physical processes of erosion and wave action can cause corroded items to leak, releasing chemicals to beach sediments and water, and to the air if the chemicals are volatile. Even items that corroded and leaked while buried can be a threat when exposed by beach erosion, because chemicals that are persistent (i.e., CS, BZ, etc.) will remain in the containers and the immediately surrounding soil for long periods of time. Those containers with chemical contents that do not immediately leak when exposed by beach erosion and wave action may remain on the beach and release their contents at a later time due to accelerated corrosion and continued exposure to wave action. These items are also a substantial threat to human health if handled by trespassers or untrained workers, because of toxic and explosive chemicals. Chemical containers exposed on a beach also may be transported and eventually be under water adjacent to shoreline areas. These items will eventually release their chemical contents to the sediment and/or water. These underwater releases are a lesser threat to human health, but still a substantial threat to ecological receptors.

The principal threats associated with leakage of CWM and hazardous substances from items on beaches and in adjacent shallow waters are primarily acute rather than chronic in nature. Many of the chemicals possibly present in containers are highly toxic, and can result in severe injury or death to humans who are exposed even briefly. These chemicals are also an acute threat to aquatic life in the immediate vicinity of the release. The threats associated with a single release incident will normally be short term in nature, because many of the chemicals are not persistent in water or open air, and because of mixing and dilution in surface water. The time period

during which the acute hazard to human and ecological receptors will exist is dependant on the specific chemicals involved and also the temperature and environmental conditions at the time of release. The time period of greatest threat could range from only a few hours for volatile chemicals in hot and windy conditions, to several weeks for less volatile chemicals in cold winter conditions.

Standard remedial investigation and risk assessment techniques (i.e., using chemical concentration data from one or two sampling events) cannot effectively assess risk to future human and ecological receptors from the CWM and hazardous substances. This is because many of the chemicals are not persistent, do not leave detectable residues in the sediment, and because the threats from individual release events are short-term in nature. Because there has been no long-term, continuous monitoring of Carroll Island and Graces Quarters with frequent inspections and sampling, it is also difficult to assess the risk posed to receptors in the past. It is only possible to state that there have been no documented events of exposure to humans that have resulted in serious injury or death.

2.9 Remedial Action Objectives

Cleanup objectives were determined based on a review of available data, the remedial action objectives (RAOs), and all applicable or relevant and appropriate requirements (ARARs). Cleanup objectives consist of medium-specific goals for protecting human health and the environment. These objectives can be achieved by reducing exposure (e.g., capping an area or limiting access) as well as by reducing the level of constituents of concern.

CWM and hazardous substances at Carroll Island and Graces Quarters present a risk to human health and the environment. UXO that exists from the testing and impact areas also presents a safety hazard to human health. Quantitative cleanup objectives are not appropriate for the Operable Units B because of the lack of discernable chemical contamination; therefore, qualitative cleanup objectives were developed. The RAOs for addressing CWM and hazardous substances at Carroll Island and Graces Quarters are to:

- reduce the potential for direct human contact with CWM and hazardous substances, and

- reduce the potential for exposure of human and ecological receptors by reducing the likelihood of CWM and hazardous substance releases to air and surface water.

2.10 Description of Alternatives

Three remedial alternatives were developed and evaluated using the criteria of the NCP. The alternatives and the categories of response for each are:

Alternative l: No Action

- Required by NCP for comparison purposes.

Alternative 2: Public Access Controls with Land Use Restrictions

- Land use restriction with primary use as a limited-access Natural Resource Management Area, and secondary use for military/industrial activities,
- Access Restrictions,
- Site inspections and disposal of CWM and hazardous substances identified by site inspections.

Alternative 3: Public Access Controls, Land Use Restrictions, and Erosion Controls

- Land use restriction with primary use as a limited-access Natural Resource Management Area, and secondary use for military/industrial activities,
- Access Restrictions,
- Site inspections and disposal of CWM and hazardous substances identified by site inspections, and
- Erosion controls.

Because all alternatives will allow hazardous substances, pollutants or contaminants to remain on site, remedy reviews will be performed every five years, as required by the NCP.

2.10.1 Land Use Controls and Access Restrictions

The land use restrictions and access controls under Alternatives 2 and 3 would be similar, with restriction to primary use as a limited-access Natural Resource Management Area, and secondary use for military/industrial activities. Appropriate access controls would include warning signs, and land and water patrols. Site inspections would be conducted to identify any hazardous military materials that are exposed by natural processes.

The land use controls (LUCs) for the selected remedy for Operable Units B at Carroll Island and Graces Quarters will be implemented under detailed plans designed to assure long-term effectiveness and reliability. A Land Use Control Assurance Plan (LUCAP) will be prepared by APG. The LUCAP will specify the procedures that will be employed to assure LUCs remain effective over the long-term for all areas at APG where they may be required.[1] A Land Use Control Implementation Plan (LUCIP) will also be prepared for the selected remedy for Carroll Island and Graces Quarters, and will be an addendum to the LUCAP. The LUCIP will identify the specific LUC objectives, and will list the specific actions required to achieve each identified objective (e.g., post warning signs).

[1] Because of its procedural nature, there will be only one LUCAP for APG. Additional LUCIPs may be appended to the LUCAP for implementation of LUCs at other CERCLA Operable Units.

2.10.2 Erosion Controls

The RI/FS work has determined that much of the shoreline of Carroll Island and portions of the Graces Quarters shoreline have experienced substantial shoreline erosion during the last 150 years, and certain areas have been subject to high erosion during the last 25 years. Most of the erosion in recent years has been on the south- and southeast-facing shorelines of the eastern portion of Carroll Island and Graces Quarters. These areas are subject to erosion as a result of a high energy wave environment caused by a substantial open-water fetch from the south and historic prevailing winds from that direction. The eastern portions of the Carroll Island and Graces Quarters are also the location of the impact and test areas that are most likely to have CWM and hazardous substances.

In the FS Addendum, three erosion control technologies were concluded to be potentially applicable to various portions of the Carroll Island and Graces Quarters shorelines. These technologies included: wetlands development, which is effective in areas with low wave energy; offshore breakwaters, which are effective in areas with low to moderate wave energy; and shoreline revetments, which are effective for wave energies ranging from low to high. Detailed analysis of environmental conditions along the Carroll Island and Graces Quarters shorelines indicated that wetlands development is not applicable to the Carroll Island shoreline, due to relatively high wave energies or the presence of high quality submerged aquatic vegetation (SAV), which would be destroyed by creating new wetlands. Offshore breakwaters and shoreline revetments are applicable to different portions of the Carroll Island shoreline. Wetlands development is applicable to the portion of the Graces Quarters shoreline identified for erosion control, due to low wave energies and the absence of valuable SAV.

The approximate shoreline areas to be stabilized are shown in Figure 4 and Figure 5. Alternative 3 will reduce potential risk associated with CWM and hazardous substances, will prevent additional loss of land due to erosion, and will preserve natural resources in the vicinity of Carroll Island and Graces Quarters, including valuable upper bay habitat. The environmental control measures selected for each portion of the shoreline will be designed to provide adequate protection against a 50-year storm event while minimizing any adverse impacts to SAV, fish or wildlife habitats, or other environmental resources. The actual technology to be used will be selected in the design phase of the remediation process.

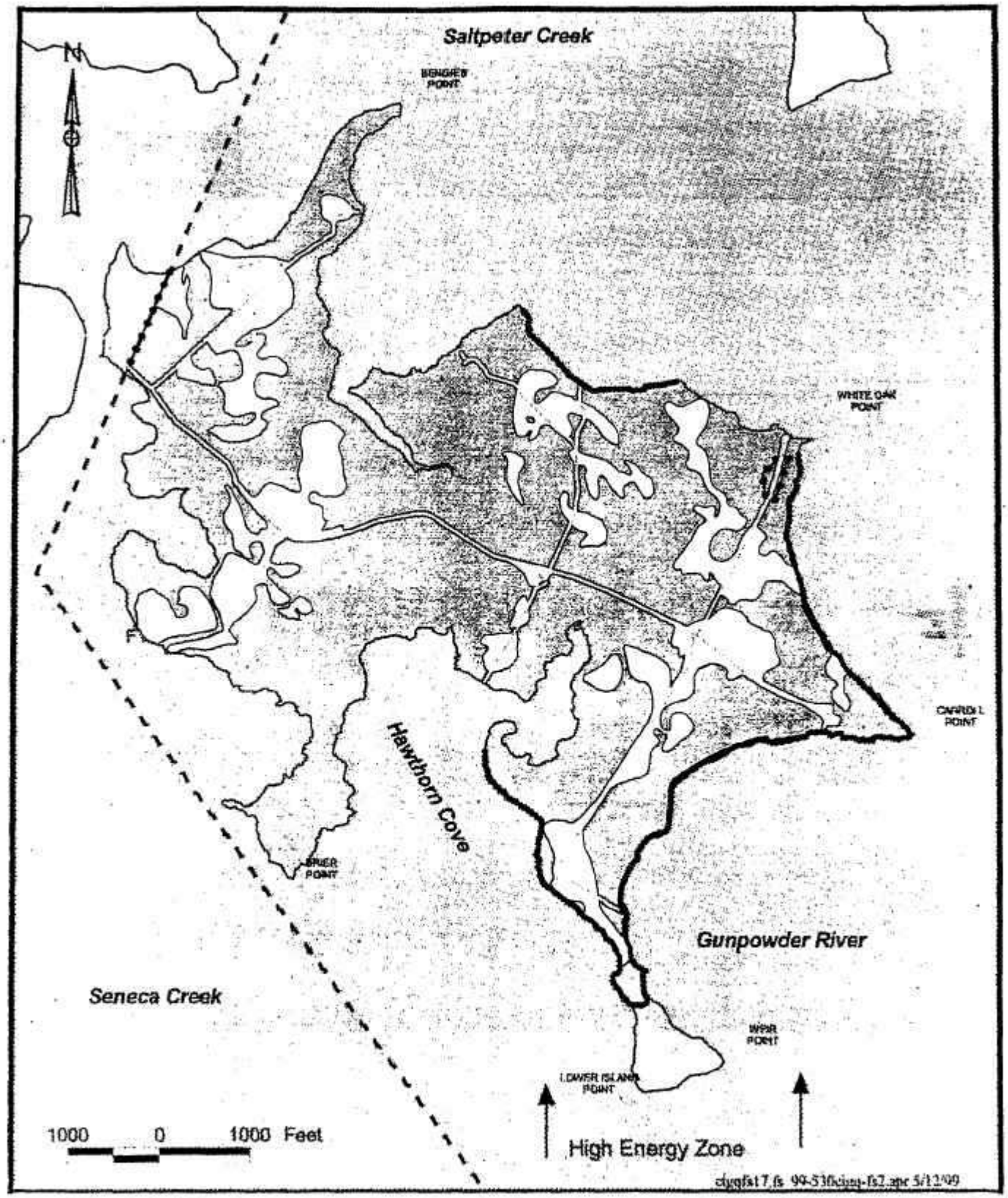
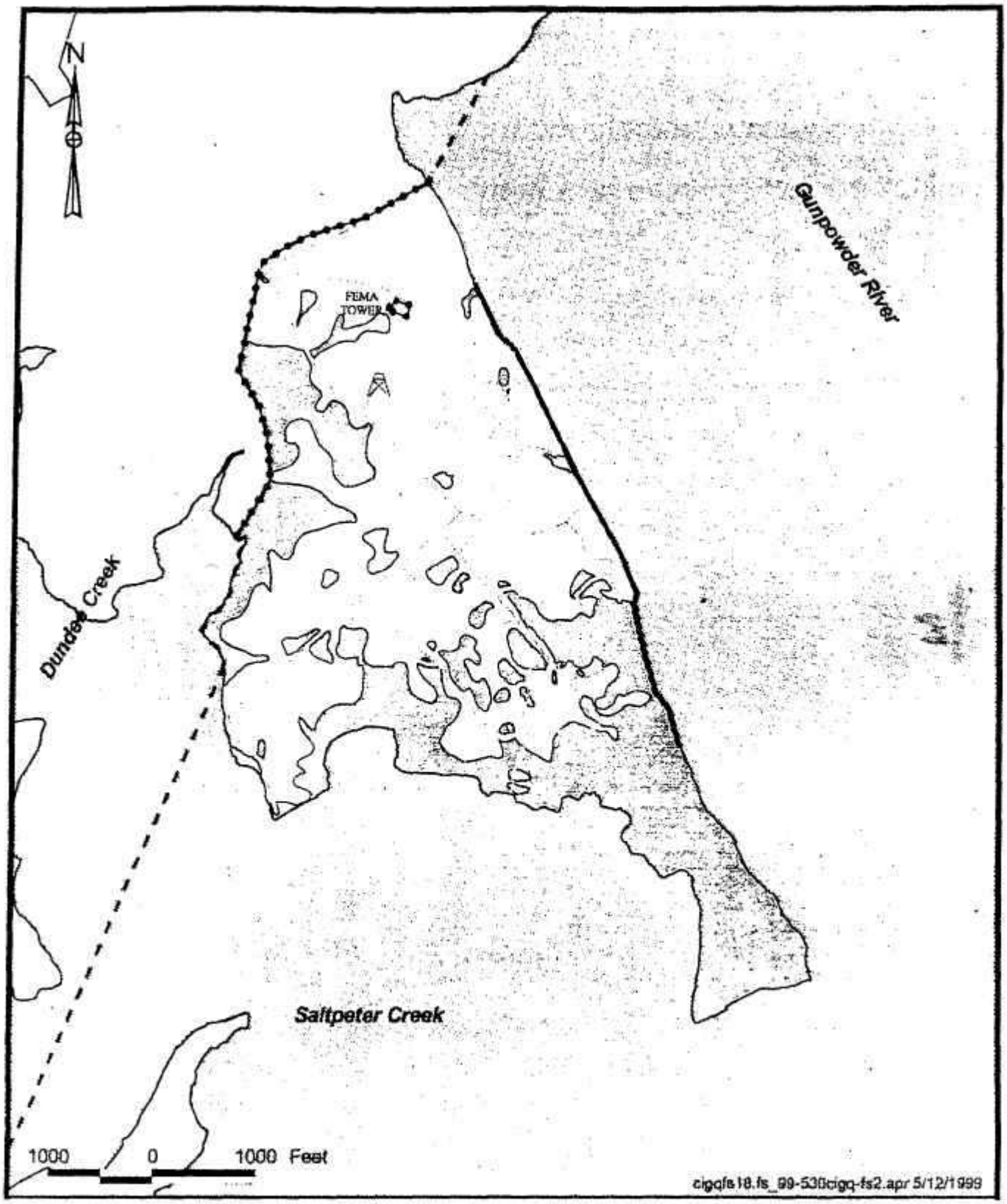


Figure 4 Carroll Island - Proposed Shoreline Erosion Controls



LEGEND

UPLAND	FILL AREAS	ABERDEEN PROVING GROUND BOUNDARY
TIDAL WETLAND/ NON-TIDAL WETLAND	ROAD	SHORELINE AREA IDENTIFIED FOR EROSION CONTROL
	FENCE	

Figure 5 Graces Quarters - Proposed Shoreline Erosion Control

2.11 Comparative Analysis of Alternatives

In evaluating the remedial alternatives for Operable Unit B, the potential performance of each alternative is evaluated in terms of the nine evaluation criteria required by the NCP:

- protection of human health and the environment;
- compliance with ARARs;
- long-term effectiveness;
- reduction of toxicity, mobility, and volume of contaminants through treatment;
- short-term effectiveness;
- implementability;
- cost;
- state acceptance; and
- community acceptance.

The nine criteria are categorized into one of three groups: threshold criteria, primary balancing criteria, or modifying criteria. The alternative selected must satisfy the threshold criteria, which are of primary importance. The primary balancing criteria are used to weigh the major tradeoffs among the alternatives, and the modifying criteria are considered after the public has commented on the Proposed Plan.

Threshold Criteria

2.11.1 Overall Protection of Human Health and the Environment

Of the three alternatives, Alternative 1 (No Action) does not achieve adequate protection of human health and the environment. Therefore, Alternative 1 is not considered further in this evaluation.

Alternative 2 (Public Access Controls with Land Use Restrictions) provides for protection of human health and is partially protective of the environment. Protection of human health for land areas is achieved through land use controls that restrict access and future land uses that are not compatible with the continued presence of CWM and hazardous substances. Protection of human health for shoreline and adjacent water areas is achieved by shoreline inspections that are conducted periodically and immediately following storm events (e.g., same day or first daylight hours of next day) to identify chemical releases and initiate response actions to immediately restrict access and remediate the site. In those instances where the exposed item has not leaked, this remedial alternative would also protect ecological receptors. In instances where there has

already been leakage of chemicals to water and shoreline sediments, this alternative would not fully protect ecological receptors.

Alternative 3 (Public Access Controls, Land Use Restrictions, and Erosion Controls) provides the highest level of protection of human health and the environment, because of the additional protection resulting from the shoreline erosion controls. The shoreline erosion controls, which would be constructed in those areas most subject to erosion, would prevent release of CWM and hazardous substances in these highest risk areas. Therefore, Alternative 3 is considered most desirable with regard to overall protection of human health and the environment, followed by Alternative 2.

2.11.2 Compliance with Applicable or Relevant and Appropriate Requirements

Chemical-specific, location-specific and action-specific ARARs for this operable unit are listed in Tables 3 through 5. Alternative 2 may not fully comply with chemical-specific ARARs because releases are not prevented, but rather remediated to the extent possible after the release. Alternative 3 would comply with chemical-specific ARARs by preventing shoreline releases, and would also comply with location-specific and action-specific ARARs.

Primary Balancing Criteria

2.11.3 Long-Term Effectiveness and Permanence

Alternative 2 is dependant on land use controls, including access controls, to ensure long-term effectiveness. The long-term effectiveness along eroding shorelines is also dependant on the effectiveness of the shoreline inspections. Alternative 2 will only have long-term effectiveness and permanence if the shoreline inspections can identify items for emergency removal prior to release of chemical contents to the air, water and sediment. Any future releases of wastes and materials on shorelines that impact the environment or result in exposures to workers or the public will be evidence that the remedy is not effective. This would likely trigger a review of the ROD, and eventual implementation of additional remedial measures. The likelihood of such future releases and exposures is uncertain. While the recently completed remediation of Carroll Island Operable Unit A disposal areas and the earlier removal actions at Graces Quarters have substantially reduced risk, there are likely other small undiscovered dump and burial sites that pose future risk. Because of the uncertainty associated with the likelihood of future shoreline chemical releases, the long-term effectiveness and permanence of Alternative 2 is uncertain.

Alternative 3 is also dependant on land use controls, including access controls, to ensure long-term effectiveness. Alternative 3 provides long-term effectiveness and permanence in preventing shoreline releases through shoreline erosion controls in areas most subject to erosion. The long-term maintenance of the shoreline erosion control measures will provide for effectiveness and permanence.

2.11.4 Reduction of Toxicity, Mobility, or Volume of Contaminants Through Treatment

Alternative 2 reduces the volume of hazardous constituents by removing detected CWM and hazardous substances for offsite destruction, when exposed at the shoreline. However, some of these exposed wastes may migrate offshore or release chemicals prior to identification

Table 3
Potential Chemical-Specific Applicable or Relevant and Appropriate Requirements
for Remedial Actions at Carroll Island and Graces Quarters
Aberdeen Proving Ground, Maryland

Media/ Constituent	Citation	Title / Category	Requirements Synopsis	Comments
Toxic Substances in Surface Water	40 CFR 131 COMAR 26.08.02	Clean Water Act, MD Water Pollution Regulations - Surface Water Quality Criteria	Specifies criteria for quality of surface water to protect human health and maintain suitability for designated uses (aquatic habitat, recreation, ect.). Establishes anti-degradation policy for water quality.	Applicable to any releases of CWM or hazardous substances to surface water.

Table 4
Potential Location-Specific Applicable or Relevant and Appropriate Requirements
for Remedial Actions at Carroll Island and Graces Quarters
Aberdeen Proving Ground, Maryland

Feature / Location	Citation	Title / Category	Requirement Synopsis	Comments
Within floodplain or wetlands	Protection of floodplains (40 CFR 6, Appendix A); Fish and Wildlife Coordination Act (16 USC 661 et seq.); 40 CFR 6.302; Floodplains Executive Order (EO 11988); Wetlands Executive Order (EO 11990) COMAR 26.23 COMAR 26.24	Protection of wetlands and floodplains	Action to avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial values; applies to action that will occur in a floodplain, i.e., lowlands, and relatively flat areas adjoining inland and coastal waters and other flood-prone areas. For action involving construction of facilities or management of property in wetlands [as defined by 40 CFR Part 6, Appendix A, Section 4(j)], action must be taken to avoid adverse effects, minimize potential harm, and preserve and enhance wetlands, to the extent possible.	Applicable to construction of shoreline erosion controls. Also potentially applicable to any future actions to recover waste from disposal sites that are exposed by shoreline erosion.

Table 4
Potential Location-Specific Applicable or Relevant and Appropriate Requirements for Remedial Actions at Carroll Island and Graces Quarters Aberdeen Proving Ground, Maryland

Feature / Location	Citation	Title / Category	Requirement Synopsis	Comments
Maryland Critical Areas	Maryland Natural Resources Code, Title 8, Subtitle 18	Chesapeake Bay Critical Area Protection Program	Establishes land use policies for the Chesapeake Bay Critical Area including limiting impervious areas, establishing buffers, and establishing controls to prevent runoff of pollutants.	Applicable to construction of shoreline erosion controls. Also potentially applicable to any future actions to recover waste from disposal sites that are exposed by shoreline erosion.
Critical habitat upon which endangered species or threatened species or threatened species depend	Endangered Species Act 1973 (16 USC 1531 et seq.); 50 CFR 402; Fish and Wildlife Coordination Act (16 USC 661 et seq.); 33 CFR 320-330, Bald and Golden Eagle Protection Act (16 USC 668-668d; 50 CFR 13 and 22)	Protection of Threatened and Endangered Species	If endangered or threatened species are present, action must be taken to conserve endangered or threatened species, including consultation with the Department of Interior.	The bald eagle is a federally listed threatened species, and at least two nests are located on Carroll Island and three nests on Graces Quarters.

Table 5
Potential Action-Specific Applicable or Relevant and Appropriate Requirements
for Remedial Actions at Carroll Island and Graces Quarters
Aberdeen Proving Ground, Maryland

Action	Citation	Title / Category	Requirement Synopsis	Comments
Waste generation from remediation of waste and contaminated media	40 CFR 261 COMAR 26.13.02	RCRA Identification and Listing of Hazardous Waste	Defines solid waste, hazardous waste, and criteria and methods for determining if a solid waste is a hazardous waste. Provides listed hazardous wastes and defines hazardous waste characteristics.	Any waste media that are actively managed or shipped off site must be tested to determine if they are RCRA characteristic wastes.
Waste generation from remediation of waste and contaminated media	40 CFR 262 COMAR 26.13.03	RCRA Standards Applicable to Generators of Hazardous Waste	States that generators of hazardous wastes are responsible for determining if wastes are hazardous and defines storage, transportation, and record keeping of hazardous wastes	Substantive requirements are applicable to management of any excavated or otherwise actively managed hazardous waste.
Treatment, storage of disposal of waste	40 CFR 264 COMAR 26.13.05	RCRA Standards for Owners and Operators of Hazardous Waste TSDFs	General performance standards for TSDFs	Applicable if there is treatment or long-term storage of hazardous waste
Management of military munitions waste	40 CFR 266 Subpart M	Munitions Rule - Solid Waste Military Munitions	Defines when a military munition is a solid/hazardous waste, and specifies requirements for transportation, storage and treatment of waste military munitions	Applicable because a portion of wastes removed under Alternative 2 or as part of construction for Alternative 3 may include waste munitions.
Construction and long-term use of wells or abandonment of existing wells	COMAR 26.04.04	Well Construction	Establishes a permitting process for well construction with reporting requirements, specifies well construction and abandonment standards, requires approval for well use as a potable water supply, and states responsibilities of well owners.	Substantive requirements are applicable if construction requires closure of any monitoring wells.

Table 5
Potential Action-Specific Applicable or Relevant and Appropriate Requirements
for Remedial Actions at Carroll Island and Graces Quarters
Aberdeen Proving Ground, Maryland

Action	Citation	Title / Category	Requirement Synopsis	Comments
Discharge of wastewater	40 CFR 122-125, 129 COMAR 26.08.04	National Pollutant Discharge Elimination System (NPDES)	Regulates direct discharges to waters of the U.S. and specifies permitting requirements	Substantive requirements are applicable to any discharge of decontamination wastewater to surface water.
Shoreline stabilization	COMAR 26.08.02.13	General Water Quality Certification for Placement of Riprap for Shore Protection	Establishes design and construction specifications, and requirements related to wetland protection, erosion and sediment control, spawning season of important aquatic species, and breeding areas of migratory waterfowl.	Applicable to construction of shoreline stabilization measures
Remedial excavation/ construction	COMAR 26.17.01	Erosion and Sediment Control	Defines erosion and sediment control during land clearing, grading, or other earth disturbances	Applicable to any excavation to remove wastes and to construction of shoreline stabilization measures
Remedial excavation/ construction	COMAR 26.17.02	Stormwater Management	Defines stormwater management during land development activities, including building and grading	Applicable to any excavation to remove wastes and to construction of shoreline stabilization measures
Remedial excavation/ construction	40 CFR 50.6 & 50.7 COMAR 26.11.06.03 COMAR 26.11.06.08	Control of Fugitive Particulate Matter	Prohibits the handling of materials and the use, construction, or demolition of buildings and roads without reasonable precautions to prevent particulate matter from becoming airborne. Requires that an installation or premises not be operated or maintained in such a way that nuisance or air pollution is created.	Applicable to any excavation to remove wastes and to construction of shoreline stabilization measures

Table 5
Potential Action-Specific Applicable or Relevant and Appropriate Requirements
for Remedial Actions at Carroll Island and Graces Quarters
Aberdeen Proving Ground, Maryland

Action	Citation	Title / Category	Requirement Synopsis	Comments
Air emissions by stationary sources	40 CFR 61 COMAR 26.11.15-16	National Emission Standards for Hazardous Air Pollutants	Establishes emissions requirements for various hazardous air pollutants, including certain chlorinated VOCs and radionuclides.	Potentially applicable to situations involving release of hazardous substances to the atmosphere
Remedial construction	COMAR 26.02.03	Noise Pollution Control	Establishes noise standards for industrial, commercial and residential zones.	Applicable to any excavation to remove wastes and to construction of shoreline stabilization measures

and recovery, creating a threat to human health and the environment. Alternative 3 also achieves a small reduction in the volume of hazardous constituents by removal of wastes in the shoreline construction area. The volume of hazardous substances removed in Alternative 3 is less than in Alternative 2, because the shoreline erosion controls will reduce the amount of these substances that will become exposed. However, Alternative 3 also reduces the mobility of these hazardous substances by ensuring that they are not exposed along eroding shorelines causing release to air and water. Because the reduction in mobility by Alternative 3 effectively reduces risk, while the reduction in volume under Alternative 2 is associated with increased risk, Alternative 3 is rated higher with respect to this criterion.

2.11.5 Short-Term Effectiveness

Alternative 2 is the most desirable alternative with respect to this criterion because there is minimal impact to workers, and the public is protected. Alternative 3 is less desirable than Alternative 2 with respect to this criterion because of the construction activities associated with implementing the shoreline erosion controls. UXO surveys and related clearance activities, and other health and safety precautions such as the use of personal protective equipment will be required in Alternative 3 to protect workers; in addition, surface water controls, soil erosion controls, and other temporary environmental controls will be required to minimize environmental impacts due to construction.

2.11.6 Implementability

Alternative 2 is easily implementable, because all resources required for the public access controls and for management of the land are readily available. Alternative 3 is also not expected to be difficult to implement, but several implementation issues need to be considered, including the length of time required to place fill material and develop the wetlands (if selected as a technology), which is expected to be approximately two to five years, and maintenance requirements associated with the offshore breakwater and revetments. In addition, regulatory coordination will be required during the design of Alternative 3 to address ARARs related to construction in a floodplain / Maryland Critical Area.

2.11.7 Cost

The total estimated present worth costs of Alternatives 2 and 3 are approximately $2,030,000 and $5,170,000, respectively, for both Carroll Island and Graces Quarters. The estimated capital costs are $106,000 and $3,210,000, respectively for the two alternatives. A detailed breakdown of these costs is presented in the FS Addendum. These present worth costs are based on an operating period of 30 years and a discount factor of 7 percent.

Alternative	Capital Cost	Present Worth of O&M Cost	Total Present Worth Cost
Alternative 2 – Public Access Controls with Land Use Restrictions	$106,000	$1,924,000	$2,030,000
Alternative 3 – Public Access Controls, Land Use Restrictions and Erosion Controls	$3,210,000	$1,960,000	$5,170,000

Although the cost of Alternative 2 can be calculated, the fact that the long-term effectiveness and permanence of Alternative 2 is uncertain raises the possibility that additional remedial actions may be required in the future. A future decision to implement additional remedial actions would be accomplished through a remedy review that could be either within the 5-year cycle for such reviews, or could be triggered by a chemical release that would indicate that land use controls and shoreline inspections alone (Alternative 2) are not effective. If the remedy review was triggered by a chemical release, there may be community and political pressure to implement a remedy that is even more aggressive than shoreline erosion controls, with substantially higher costs.

There is much less uncertainty associated with the cost for Alternative 3, because of the long-term effectiveness and permanence of this remedy. Considering uncertainties, it is possible that Alternative 3 is also the alternative with the lowest long-term cost.

Modifying Criteria

2.11.8 State Acceptance

The Maryland Department of the Environment (MDE), Waste Management Administration, concurs with the selection of Alternative 3 for Carroll Island and Graces Quarters.

2.11.9 Community Acceptance

The community prefers and has accepted Alternative 3 during the public comment period.

2.12 Principal Threat Waste

Any lethal chemical agents that possibly exist at Carroll Island and Graces Quarters in containers are considered to be principal threat waste because of their high toxicity.

Site inspections and geophysical techniques have been employed in suspect areas to identify wastes, and all such materials have already been remediated. It is still possible that CWM materials exist but could not be found using existing technology. Nevertheless, there are no additional positively-identified areas that contain CWM or hazardous substances on Carroll Island and Graces Quarters.

Any principal threat waste that is discovered by site inspections or other activities at Carroll Island or Graces Quarters will be destroyed or removed for disposal by the U.S. Army using existing emergency response procedures that are protective of human health and the environment. The selected remedy will minimize the likelihood that principal threat waste will be released to the air or surface water.

2.13 The Selected Remedies

An evaluation of potential alternatives was performed in accordance with the NCP as summarized in Section 2.11. Based on this evaluation, the selected alternative for Operable Units B at Carroll Island and Graces Quarters is Alternative 3, “Public Access Controls, Land

Use Restrictions, And Erosion Controls," with a total cost of $5,170,000. The selected alternative for the other sites listed in Tables 1 and 2 is "No Further Action".

These selected remedies are protective of both human health and the environment, effective in meeting RAOs, and permanent solutions. All of the selected remedies will comply with ARARs and will not pose short-term risks to remedial workers, the community, or the environment. The selected remedies are easily implemented with relatively low cost. In addition, the remedies meet State and Federal regulatory requirements and are accepted by the community.

The selected remedies were chosen over other alternatives, because they represent the solutions that best satisfy the nine criteria specified by EPA to be considered in remedy selection.

The specific LUC objectives for the Carroll Island and Graces Quarters Operable Units B remedy are:

- Restrict future land usage to either military/industrial activities or a limited-access natural resource management area.

- Restrict public access to Carroll Island and Graces Quarters by employing reasonable measures to prevent inadvertent exposure of individuals to CWM, hazardous substances and UXO.

The current land use designation for Carroll Island and Graces Quarters in the APG Master Plan is open space. The future land use designation will be primary use as a limited-access natural resource management area, and secondary use for military/industrial activity. APG will continue to be responsible for natural resource management activities at Carroll Island and Graces Quarters.

The baseline risk assessment did not identify any unacceptable risks to current or hypothetical future receptors from exposure to constituents in environmental media at Carroll Island or Graces Quarters. The most conservative (highest exposure) receptor evaluated in the baseline risk assessment was a natural resources management worker, with exposure factors the same as the standard EPA default exposure factors for industrial workers.

2.14 Performance Standards

The erosion control measures will be constructed along the shoreline areas most subject to erosion, with roughly three miles of shoreline being protected (Figures 4 and 5). The specific measures to be implemented for erosion control will be determined in the design phase of the remediation process. The measures selected for various shoreline areas will be designed to provide adequate protection against a 50-year storm event, while minimizing any adverse impacts to habitat and other environmental resources.

The land use control objectives are:

- restrict future land use to primary use as a limited-access Natural Resource Management Area, and secondary use for military/industrial activities;

- restrict unauthorized access;

- prohibit future land use that is incompatible with and would disrupt the effectiveness of the engineered/constructed shoreline erosion controls.

Unauthorized access to Carroll Island and Graces Quarters will continue to be controlled by signs, chain link fences with locked gates, random security patrols and other physical measures. Signs along the fence and shoreline areas will also be maintained to inform boaters of potential hazards present on beaches and land.

Future land use will be controlled by designating in the APG Master Plan the future use for Carroll Island and Graces Quarters as natural resource management and military/industrial usage. Any proposed changes in land usage, or proposed activities that would disrupt the effectiveness of the engineered shoreline erosion controls, will be reviewed by APG DSHE. APG will notify EPA Region III and MDE of planned changes in land use for Carroll Island and Graces Quarters. APG will also notify EPA and MDE in the event that the transfer by sale or lease is contemplated for any portion of Carroll Island and Graces Quarters.

APG will develop a LUCAP that specifies the procedures for implementing land use controls at APG sites for which a ROD has been signed. APG will also develop a LUCIP for Carroll Island and Grace Quarters. The LUCIP will specify land use control procedures and access control measures to be implemented at this site. In addition, the LUCAP/LUCIP will specify the frequency of inspections of Carroll Island and Graces to verify no significant change in land use and the frequency of certification of the compliance with LUCs specified in this ROD. The frequency of and procedures for conducting shoreline inspections at Carroll Island and Graces Quarters will also be specified in the LUCIP. These shoreline inspections will be initiated following completion of the LUCIP, and prior to the construction of the shoreline erosion control measures. The LUCIP will also specify the reduced frequency of inspections that will be performed after the construction of the shoreline erosion controls.

2.15 Statutory Determinations

Based on the findings of the RI, the Carroll Island and Graces Quarters Operable Units B pose risk to human health. Therefore, a determination has been made that public access controls, land use restrictions, and erosion controls are appropriate and protective of human health.

Based on the findings of the RI, and on accomplishment of removal actions to remove possible sources of hazardous materials, the other Carroll Island and Graces Quarters sites listed in Tables 1 and 2 pose no further risk to human health or the environment. Therefore, no further action is necessary for these sites.

The selected remedies are protective of human health, comply with Federal and State of Maryland requirements that are legally applicable or relevant and appropriate to the remedial action, and are cost effective.

The selected remedies are permanent solutions and satisfy, to the extent practicable, the statutory preference for reduction of toxicity, mobility, and volume of contamination through treatment.

Section 300.430(f)(4)(ii) of the NCP requires that a 5-year review of the ROD be performed if hazardous substances, pollutants, or contaminants remain at the unit. The three parties, Department of the Army, MDE and EPA, have determined that a 5-year review of the ROD for the Carroll Island and Graces Quarters Operable Units B will be performed to ensure continued protection of human health.

2.16 Explanation Of Significant Changes

The original proposed plan for remediation at Carroll Island and Graces Quarters Operable Units B was released for public comment in July 1998, with land use controls identified as the preferred alternative. The public expressed concerns about shoreline erosion exposing CWM and hazardous substances on beaches. In response, APG reevaluated possible remedial alternatives, and in April 2000 released a second proposed plan with a new preferred remedy consisting of LUCs and shoreline erosion controls. There have been no significant changes to this preferred remedy since the second proposed plan was presented. Additional background information on community involvement in this decision process is presented in the responsiveness summary.

3 RESPONSIVENESS SUMMARY

The Responsiveness Summary is provided as Appendix A of this document.

4 REFERENCES

AEHA, 1989. *RCRA Facility Assessment Report, Edgewood Area, Aberdeen Proving Ground, Maryland*. Report No. 39-26-0490-90. US Army Environmental Hygiene Agency, Aberdeen Proving Ground, Maryland. December 1989.

APG and EPA, 1990. *Federal Facility Agreement, Aberdeen Proving Ground, Maryland.* Administrative Docket Number III-FCA-CERC-004. United States Environmental Protection Agency Region III and the United States Department of the Army. 27 March 1990.

APG, 1996. *Record of Decision, Operable Unit A, Carroll Island, Aberdeen Proving Ground, Maryland*. Directorate of Safety, Health and Environment, Aberdeen Proving Ground, Maryland. September 1996.

APG, 1998. *Decision Document, Removal Action of a Sump Associated with the Former Service Area at Carroll Island*. Environmental Conservation and Restoration Division, Directorate of Safety, Health and Environment, Aberdeen Proving Ground, Maryland. October 1998.

Dames & Moore, 1997. *Remedial Investigation Report, Carroll Island, Aberdeen Proving Ground, Maryland*. Dames & Moore, Bethesda, Maryland. October 1997.

Dames & Moore, 1998. *Remedial Investigation Report, Graces Quarters, Aberdeen Proving Ground, Maryland*. Dames & Moore, Bethesda, Maryland. January 1998.

Dames & Moore, 1999a. *Combined Feasibility Study Addendum, Carroll Island and Graces Quarters, Aberdeen Proving Ground, Maryland*. Dames & Moore, Bethesda, Maryland. November 1999.

Dames & Moore, 1999b. *Proposed Plan for Operable Units B: CWM and Other Hazardous Substances and for Removal Actions at the Service Area and the Wind Tunnel at Carroll Island and the Service Area and Disposal Area at Graces Quarters, Aberdeen Proving Ground, Maryland*. Dames & Moore, Bethesda, Maryland. November 1999.

GP, 1997. *Carroll Island and Graces Quarters Boundary Survey, Technical Report*. General Physics Corporation, Edgewood, Maryland. November 1997.

GP, 1998. *Carroll Island and Graces Quarters Boundary Survey, Technical Report for Subsurface Magnetic Anomaly Survey and Hazard Assessment*. General Physics Corporation, Edgewood, Maryland. December 1998.

ICF, 1998. *Community Relations Plan for Installation Restoration Program, U.S. Army Garrison, Aberdeen Proving Ground*. Updated by ICF Kaiser Engineers, Edgewood, Maryland. May 1998.

ORISE, 1998a. *Combined Feasibility Study Report, Carroll Island and Graces Quarters*. Oak Ridge Institute of Science and Education, Oak Ridge, Tennessee. July 1998.

ORISE, 1998b. *Proposed Plan for Operable Unit B, CWM and Other Hazardous Substances Including UXO, Carroll Island and Graces Quarters*. Oak Ridge Institute of Science and Education, Oak Ridge, Tennessee. July 1998.

USGS, 1991. *Hydrogeologic Data for Carroll Island, Aberdeen Proving Ground, Maryland,* Open File Report 89-388. United States Geological Survey, Towson, Maryland.

USGS, 1996. *Hydrogeology and Chemical Quality of Water and Soil at Carroll Island, Aberdeen Proving Ground, Maryland*. United States Geological Survey, Towson, Maryland.

APPENDIX A

CARROLL ISLAND AND GRACES QUARTERS
OPERABLE UNITS B
PROPOSED PLAN
RESPONSIVENESS SUMMARY

The final component of the Record of Decision is the Responsiveness Summary. The purpose of the Responsiveness Summary is to provide a summary of the public's comments, concerns, and questions about Carroll Island and Graces Quarters (Operable Units B) and the Army's responses to these concerns.

APG held a public meeting on May 11, 2000 to formally present the Proposed Plan and to answer questions and receive comments. The transcript of this meeting is part of the administrative record for the site. During the public comment period, APG also received written comments. All comments and concerns summarized below have been considered by the Army and EPA in selecting the cleanup method for Carroll Island and Graces Quarters.

This responsiveness summary is divided into the following sections:

- Overview
- Background on Community Involvement
- Summary of comments received during the public comment period and APG's responses.
- Sample newspaper notice announcing the public comment period and the public meeting.

OVERVIEW

At the time of the public comment period, the Army had endorsed a preferred alternative for Carroll Island and Graces Quarters. APG proposed restricting use of the land to a natural resource management area, with any future Army activities to be compatible with this designation. APG also proposed additional access controls, shoreline erosion control measures, and shoreline inspections to locate any wastes that may surface. The shoreline inspections will initially be twice per month and after major storm events. The frequency of shoreline inspections will be reduced after the erosion control measures are constructed. The frequency of inspections under long-term operations will be specified by design documents. The frequency will also be adjusted in the future, depending on the findings of the inspections, with these changes being coordinated with regulatory authorities and the community. EPA and MDE concur with the Army's preferred alternative. The community also seems to agree with the selected alternative.

BACKGROUND ON COMMUNITY INVOLVEMENT

Citizens in Baltimore County living near APG's Carroll Island and Graces Quarters Study Areas have actively expressed interest in the sites since the early 1990s.

APG has maintained an active public involvement and information program. Highlights of the community's involvement in the original Proposed Plan and the revised Proposed Plan and APG's activities during the last few years follow:

- APG began discussing the Carroll Island and Graces Quarters Study Areas and ongoing environmental investigations with the Restoration Advisory Board in April 1995. Other Board meetings where APG presented information on the two study areas included October 1995, May 1996, and September 1997. In January 1997, APG discussed the Feasibility Study for Operable Units B. The Board further discussed the Feasibility Study at the January 1998 meeting. In June 1998, APG distributed a draft Proposed Plan at the Board meeting for members to review and provide their comments.

- In late 1997 and early 1998, APG formed a Baltimore County Citizens Committee as an additional way to involve citizens near Carroll Island and Graces Quarters in the decision-making process. APG presented information on the Feasibility Study at the first meeting of the Committee in February 1998 and on the tour in June 1998.

- APG released a Proposed Plan for Carroll Island and Graces Quarters for public comment on July 22, 1998. Copies were available to the public at APG's information repositories at the Aberdeen and Edgewood Branches of Harford County Library, and Miller Library at Washington College. A copy of the Proposed Plan also was posted on the Installation Restoration Program's Web Site, and the public was invited to comment through the Web Site. A 45-day public comment period on the Proposed Plan ran from July 22 to September 4, 1998. On July 29, APG held a public meeting at the Bowleys Quarters Fire Station.

- Comments received from the public on the proposed plan indicated a preference for Alternative 2, public access controls with land use restrictions, but concerns were expressed about shoreline erosion continuing to uncover materiel on the beaches that could migrate into the Bay. Community members were concerned about the possible release of chemicals into the air or water. Community members were particularly concerned because of the extensive use of the surrounding waterways for recreational purposes such as boating and fishing. Local residents, community members of APG's Restoration Advisory Board, and the APG Superfund Citizens Coalition requested APG re-examine alternatives for reducing shoreline erosion and thus preventing any materials from entering surface water bodies or re-examine technologies for detecting any such buried materials and removing them.

- In response to the concerns raised about shoreline erosion, a Feasibility Study Addendum and a new Proposed Plan for Carroll Island and Graces Quarters were prepared.

- The new Proposed Plan was discussed at the December 1998, February 1999, July 1999, and December 1999 meetings of the Restoration Advisory Board.

- The new Proposed Plan for Carroll Island and Graces Quarters was released for public comment in April 2000. Copies were made available to the public at APG's repositories at the Aberdeen, Joppa and Edgewood Branches of Harford County Library, Miller Library at Washington College, and the Cecilton Branch of the Cecil County Library. A copy of the Proposed Plan also was posted on the Installation Restoration Program's web site, and the public was invited to comment through the web site.

- A 45-day public comment period on the new Proposed Plan ran from April 26 to June 9, 2000.

- APG prepared a release announcing the availability of the new Proposed Plan, the dates of the public comment period, and the date and time of the public meeting. APG placed newspaper advertisements announcing the public comment period and meeting in The Aegis, The Avenue, The Cecil Whig, The East County Times and The Kent County News.

- APG prepared and published a fact sheet on the Proposed Plan including information on the public meeting. APG mailed copies of this fact sheet to over 2,700 citizens and elected officials on its Installation Restoration Program mailing list. The fact sheet included a form which citizens could use to send APG their comments.

- On May 11, APG held a public meeting at Oliver Beach Elementary School in Chase, Maryland. Representatives of the Army and the MDE were present. APG representatives presented information on the site and on the proposed cleanup alternatives.

SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND AGENCY RESPONSES

Comments raised during the public comment period on the Carroll Island and Graces Quarters Proposed Plan are summarized below. The comments are categorized by source.

COMMENTS FROM QUESTIONNAIRE INCLUDED WITH FACT SHEET

As part of its fact sheet on the Proposed Plan, APG included a questionnaire that residents could return with their comments. APG received 11 forms. The alternatives preferred by individuals returning comment forms were:

0	Alternative No. 1 - Take No Action.
1	Alternative No. 2 - Public Access Controls with Land Use Restrictions
10	Alternative No. 3 – Public Access Controls, Land Use Restrictions and Erosion Controls
0	Have no preference

Written comments included on the forms are summarized below.

Comment No. 1: [Commenter selected alternative 2] "I feel that alternative #2 would be more effective on getting rid of any waste buried on the shoreline. With an inspection twice a month or after a major storm this would ensure the removal of any waste surfacing. Two times a month sounds better than two times a year. Less exposure when something does surface."

Response No. 1: Fewer inspections are needed with Alternative 3 as the shoreline erosion control and stabilization measures reduce the possibility of waste becoming exposed. APG agrees with the need to conduct inspections twice per month and after major storm events during the period prior to shoreline stabilization. The frequency of inspections will be reduced after the shoreline is stabilized. The frequency will also be adjusted in the future, depending on the findings of the inspections, with these changes being coordinated with regulatory authorities and the community. These adjustments may either increase or decrease the frequency. It is expected that there will always be inspections after major storm events, to verify that shoreline erosion control measures remain intact, and to identify any wastes on shoreline areas that have not been stabilized.

Comment No. 2: [Commenter selected alternative 3] "I think it is good to have the erosion controls, but I hope there will still be adequate inspection (twice a year seems pretty infrequent), since I would think that even with erosion controls, materials may become exposed - especially after major storms."

Response No. 2: The shoreline erosion control measures are expected to prevent all releases in the stabilized areas where most erosion occurs. The frequency of inspection in areas of lesser erosion that have not been stabilized will be such that health and the environment are protected. APG does agree that even when inspection is reduced from twice per month after shorelines stabilization is completed, that the frequency should be greater than twice per year to ensure that the remedy is effective. Many factors will be considered when determining the appropriate frequency for inspections. For example, inspections may be more frequent during warmer months when there are more boaters in the waters adjacent to Carroll Island and Graces Quarters. As noted in the previous response, it is expected that there will always be inspections after major storm events, to verify that shoreline erosion control measures remain intact, and to identify any wastes on shoreline areas that have not been stabilized. All of these factors will be evaluated when preparing remedy design documents where inspection frequency will be specified.

Comment No. 3: [Commenter selected alternative 3] "While I agree with the chosen alternative, I feel that during the first two years after completion the beach patrols should occur more than 2 times per year to ensure the erosion controls are working properly. If erosion does occur, it would be noticed and corrected more quickly with more frequent beach patrols."

Response No. 3: APG agrees and inspections are expected to be more often than twice per year, and will always be conducted after major storm events.

Comment No. 4: [Commenter selected alternative 3] "Since Baltimore County is revitalizing the northeastern end of the county so people have access to the water, I think it would be a good idea to build a fishing pier or boat ramp at the end of Graces Quarters."

Response No. 4: APG understands the desire of the local communities to have access to the waterways for which the proving ground is responsible. The current restrictions on use of the waterways are in place for the safety of the waterway users and would prohibit the building of a pier or ramp at this time due to the possible presence of ordnance in the waterways from historic testing activities. The Department of Defense, as well as the Army and APG, are working on the

many issues involved with the safe removal of munitions including researching better detection technology and destruction technology. Every five years there will be a remedy review at which time consideration will again be given to remedial approaches that would allow unrestricted land use.

Comment No. 5: [Commenter selected alternative 3] "Let us not make a mistake of Love Canal in NY, where the company was forced to give up the property; the US Government should never relinquish ownership. We do not know what may come up to surface, considering the toxicity of material tested in the past. Maybe a better surveillance is needed, automatic alarms, etc., etc."

Response No. 5: There are no plans at this time for the Army to relinquish ownership of the land. APG and EPA expect the controls and inspections being put in place to adequately protect human health and the environment. However, the remedy will be reviewed after implementation to ensure that it is providing adequate protection and additional measures would be implemented if it were not adequate. Furthermore, there will be notification and coordination with EPA and MDE in the future if any major change in land use or transfer of land ownership is proposed. Additional protective measures would be implemented at that time, as necessary and appropriate.

COMMENTS AT THE MAY 11, 2000 PUBLIC MEETING

A full transcript of the public meeting is at APG's information repositories. Following is a summary of the one comment made at the meeting.

Comment No. 6: A resident asked if the Federal Government would fund the remedial action plan.

Response No. 6: Yes. Funds for remedial actions come from the Defense Environmental Restoration Program and will probably be available for implementing this remedial action in 2002/2003.

WRITTEN COMMENTS RECEIVED

APG received written comments from the community co-chair of the APG Restoration Advisory Board, a local citizen, the APG Superfund Citizens Coalition, and the Maryland Department of the Environment.

Community Co-Chair, APG Restoration Advisory Board

Comment No. 7: "I agree with Alternative 3 and with the removal actions. The Proposed Plan was very thorough and covered everything from the past to the future for the sites."

Response No. 7: APG appreciates the feedback on the plan.

APG Superfund Citizens Coalition

"In general, APGSCC supports the preferred alternative for Operable Units B, which includes public access controls, land-use restrictions and erosion controls." APGSCC submitted the following two comments.

Comment No. 8: "Mercury Contamination at the Northeast Test Hut Site. While the results of the bioaccumulation study indicated that the risk to ecological receptors was minimal, it must be emphasized that the reason the risk was minimal was due to the limited area of contamination. In fact, the most highly contaminated soil was removed to provide soil for the bioaccumulation experiments. Members of the EPA Biological Technical Assistance Group (BTAG) emphasized that if the contamination was more widespread removal would be warranted. This point was not emphasized in this report, but should be."

Response No. 8: APG agrees with this comment.

Comment No. 9: "Remediation of Disposal Sites at Graces Quarters. While most disposal areas in the Carroll Island Study Area were designated for accelerated action and remediated, none of the disposal areas in Graces Quarters were designated as such, despite their upland location. Instead, most of the disposal sites were included in the Graces Quarters Operable Unit B. While the presence of marshes would make it difficult (impossible) to identify the location of chemical warfare material and unexploded ordnance using current technologies, presumably magnetometry, EM and GPR could be used for the upland sites. Why was the decision made to not excavate these sites?"

Response No. 9: The disposal areas at Carroll Island were proposed for remedial action because APG's environmental studies indicated the potential for hazardous material to be buried at these areas. At Graces Quarters, APG excavated suspected hazardous material disposal pits through a removal action because the pits were very close to the shoreline and continuing erosion created a potential for the pits to continue to erode into the surface water. Environmental sampling of the remaining suspected disposal areas at Graces Quarters found no indication of the presence of hazardous material and thus additional action is not warranted. The suspected disposal areas at Graces Quarters were not designated disposal areas and it is less likely waste was buried at these areas than at Carroll Island; the waste found appeared to be scattered surface debris. Additional geophysical studies would not be able to detect non-metallic objects (such as laboratory glassware that could contain hazardous substances). Therefore, APG is proposing the protective measures in Alternative 3 because of the possibility hazardous substances could be present.

Local Citizen

APG received one letter commenting on the Proposed Plan. The individual did not indicate a preference for any of the alternatives, but made the following comments:

Comment No. 10: The commenter mentioned that his family has owned land near Carroll Island for almost 60 years. "My concerns with your three alternatives are that I don't think any of them go far enough to preserve the property. Carroll Island is an asset to the area. It abounds with deer, eagles, and other wildlife, and the waters surrounding it flourish with fish and crabs.

However, it is rapidly eroding away - - and the changes are visible more every year. I can recall when the small island at the mouth of the Gunpowder River was still connected to the main island. Through erosion, however, we now have 2 separate islands. Eventually I'm sure all the land will be eroded away.

"I respect the fact that your main concern is public safety in that you want to assure that any 'wastes' are addressed - - - but I feel more should be done to preserve the land itself. So here are my questions:

1. Exactly what will you receive for the $5,170,000? Will this include shoreline preservation and reconstruction? For the entire island? Or just where 'waste' is discovered? Is the $5,170,000 a one-time expenditure - - or would this amount be spent every year?

2. Would it be possible for you to form a partnership with another government agency (the Department of the Interior?) that could help with funding aimed at a comprehensive land preservation project?

3. Is there any possibility that the island could some day be used as a Federal park or as a nature study preserve?"

Response No. 10: Remedial Alternative #3 includes land use restrictions, public access controls and shoreline erosion control measures. APG will manage the land as a natural resource management area. Warning signs will be posted along the shoreline, and additional patrols will monitor the area to deter trespassing. Visual inspections will be performed periodically and after any significant storm event to locate any chemical warfare materiel or unexploded ordnance that surfaces as a result of shoreline erosion. Approximately three miles of shoreline at Carroll Island and Graces Quarters will be stabilized. The control and stabilization measures are planned for areas where erosion is greatest and waste may have been disposed. The $5,170,000 is the total cost for implementing Alternative #3.

Current plans are for the Army to retain ownership and to manage the land as a natural resource management area with limited Army usage. It is possible the Army could allow limited public access for guided tours. Because there is a potential for chemical warfare materiel to still be present, it is not likely the property could be used as a park with unrestricted access.

Maryland Department of the Environment

The Federal Facilities Section of the Waste Management Administration provided the following comments.

Comment No. 11: "Because the preferred alternative will allow a hazardous substance to remain on site, the text should include the provisions for five-year reviews. These five-year reviews should be associated with alternatives 2 and 3."

Response No. 11: APG agrees that a five-year review should be conducted for the preferred remedial action and has provided for this in the Record of Decision.

Comment No. 12: "The text states that no further action is required for 17 individual sites referenced in the bulleted list preceding this paragraph. The Primary Test Area is included in the list of No Further Action sites. Please clarify that the no action decision listed in this section excludes the groundwater beneath the Primary Test Area, and that remedial action is anticipated for this separate operable unit. This distinction should be made in the final Record of Decision and other applicable documents referencing this site."

Response No. 12: APG has clarified in the Record of Decision that groundwater remediation at Graces Quarters is a separate Operable Unit.

U.S. ARMY INVITES PUBLIC COMMENT ON A NEW PROPOSED PLAN FOR ITS CARROLL ISLAND AND GRACES QUARTERS STUDY AREAS

Aberdeen Proving Ground (APG) invites the public to comment on a new Proposed Plan for its Carroll Island and Graces Quarters Study Areas, located in Baltimore County. This Proposed Plan adds erosion control measures as requested by local residents and community groups.

WRITTEN COMMENTS

The public may submit written comments on the Proposed Plan during the 45-day comment period (April 26 to June 9, 2000). Comments must be postmarked by June 9 and may be sent to any of the following:

Mr. Ken Stachiw
U.S. Army Garrison
ATTN: AMSSB-GSH-ER
5179 Hoadley Road
APG, MD 21010

Mr. Steve Hirsh
U.S. Environmental Protection Agency
1650 Arch Street (3HS50)
Philadelphia, PA 19103

Mr. John Fairbank
Maryland Department of the Environment
Waste Management Division
2500 Broening Highway
Baltimore, MD 21224

FACT SHEET

APG has prepared a fact sheet on the Proposed Plan that includes a comment form that can be returned to APG. If you are not on APG's mailing list, you can request a copy of the fact sheet by calling APG's 24-hour Environmental Information Line at (410) 272-8842 or (800) APG-9998.

PUBLIC MEETING

APG invites the public to attend a meeting on:

DATE: Thursday, May 11, 2000

TIME: 6:30 p.m. – poster/ information session
7:15 p.m. - presentation

PLACE: Oliver Beach Elementary School Cafetorium
12912 Cunninghill Cove Road
Baltimore, MD 21220

The meeting location is wheelchair accessible, and an interpreter for the hearing impaired is available with 72 hours advance notice to Mr. George Mercer at (410) 278-1147.

WEB SITE

You can review the Proposed Plan and provide comments through the APG Web Site at www.apg.army.mil; click on "Garrison," "Safety, Health & Environment," "Environmental Cleanup Web Site," and "Documents" to review the plan, and "Public Participation" and "e-mail response form" to submit comments.

PROPOSED ACTION

APG conducted comprehensive environmental investigations at both study areas and implemented a number of removal actions. It is possible that some wastes, including chemical warfare materiel, associated with historic testing and support activities may not have been located due to the difficulty of detecting these wastes with existing technology. APG is proposing remediation to reduce the possibility of exposure to humans or to the environment and the Chesapeake Bay. The public also is invited to comment on the adequacy of the removal actions already conducted.

ALTERNATIVES EVALUATED

APG, EPA and Maryland Department of the Environment evaluated the following alternatives:

Alternative 1: No Action. The law requires APG evaluate taking no action to establish a baseline for comparison with other alternatives. **Cost: $0.**

Alternative 2: Public Access Controls with Land Use Restrictions. Land use of the sites would be restricted to a natural resource management area. Any future Army activities would be compatible with this designation. These restrictions would be incorporated into APG's Master Plan and real property transfer documents in the unlikely event the Army would ever sell the property. APG would conduct beach inspections and increase land and boat patrols and warning signs to deter public trespassing. **Cost: $2,030,000.**

Alternative 3: Public Access Controls, Land Use Restrictions, and Erosion Controls. This alternative includes all of the remediation activities in Alternative 2 except beach inspections would be conducted less frequently. Shoreline erosion control measures would be included where erosion has occurred in the past and where chemical warfare materiel and other hazardous substances may be present. **Cost: $5,170,000.**

Based on their analysis of the alternatives, APG and EPA prefer Alternative 3, Public Access Controls, Land Use Restrictions, and Erosion Controls.

The preferred alternative may be modified or a new alternative may be developed based on public input. The final alternative selected will be documented in a Record of Decision that summarizes the decision-making process. APG will summarize and respond to comments received during the comment period as part of the Record of Decision. Copies of the Focused Feasibility Study and the Proposed Plan are available for review at the APG information repositories. The repositories are located at the Joppa and Aberdeen branches of Harford County Library and Miller Library at Washington College in Kent County. Copies are also available at the Edgewood and Cecilton Libraries.